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The simulation model developed in this paper demonstrates how the Logistics Composite Model (LCOM) can be used to provide a systems analysis of the base-level munitions production function. Using three categories of munitions, the model demonstrates how varying quantities of manpower, transportation equipment and storage capacity impact sortie generation. Results from simulations are analyzed to show how the output products are used to determine munitions resource requirements in support of a given sortie rate.

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AN EVALUATION OF THE SUITABILITY OF LCOM

FOR MODELING

THE BASE-LEVEL MUNITIONS PRODUCTION PROCESS

THESIS

AFIT/GSM/SM/76D-8 Michael H. Gilchrist
Major USAF

AFIT/GSM/SM/76D-8

AN EVALUATION OF THE SUITABILITY OF LCOM FOR MODELING THE BASE-LEVEL MUNITIONS PRODUCTION PROCESS

THESIS

Presented to the faculty of the School of Engineering

of the Air Force Institute of Technology

Air University

in Partial Fulfillment of the

Requirments for the Degree of Master of Science

by

Michael H. Gilchrist

Major USAF

May, 1981

PREFACE

The model developed in this paper was designed to demonstrate the applicability of the Logistics Composite Model (LCOM) in simulating the base-level munitions production process. The paper was written in support of a project sponsored by the Air Force Logistics Management Center. In this project, several simulation models were to be evaluated to determine which would be most suitable for use throughout the Air Force to determine support resource requirements for munitions production. As a demonstration, the resource quantities derived as a result of this research do not reflect actual requirements. Rather, they illustrate how achieved sortie rate can be used to measure the sortie support capability of a given set of manpower spaces, transportation equipment and storage area capacities. By conducting iterative simulations with decreasing resource quantities, the minimum requirements can be determined that will support a given flying scenario. A similar methodology using the LCOM is currently employed by the Tactical Air Forces to determine the aircraft maintenance manpower requirements for their major weapons systems. As demonstrated by the simulation results presented in this paper, the inherent flexibility and scope of the LCOM allow it to be expanded to encompass the logistics support resources pertinent to the munitions production process.

My experience in LCOM simulation was acquired while working as a manpower analyst at Headquarters, Tactical Air Command; my knowledge of munitions processing was developed during this duty in the manpower field and also as a result of the reseach conducted as part of this project. For their expert assistance, I wish to acknowledge the contribution and cooperation of the munitions personnel at HQ TAC/LGW for providing insights into the world of munitions processing. Secondly, the inputs of Captain Mark Greenly, AFLMC, deserve special mention. His previous experience as a munitions officer was a valuable source of critique for the control functions and production routines incorporated in this munitions model. In addition, the editorial comments and analytical expertise of my advisor, Lt Col Charles Mitchell, AFLMC, helped polish and refine the final drafts of this paper. Last, but by no means least, I wish to thank my wife, Sandra, whose patience and support throughout this research effort were instrumental in its completion.

As well as satisfying one of the requirements of the AFLMC project, this manuscript has been submitted to Lt Col Charles McNichols and the faculty of the School of Engineering, Air Force Institute of Technology, in partial fulfillment of the requirements for the degree of Master of Science in Operations Research. Hopefully, the capabilities of the munitions model, as demonstrated by this research, will support the adoption of the LCOM by munitions planners as a viable tool with which to determine accurate and defensible munitions support resource requirements.

Michael H. Gilchrist

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ABSTRACT

The availability of adequate munitions is a key factor in the combat effectiveness of Air Force weapons systems. To insure that availability, it is necessary to determine accurate logistics resources that support the base-level munitions production function. Current methods do not provide a systems approach to determine those requirements. The simulation model developed in this thesis demonstrates how the Logistics Composite Model (LCOM) can be used to provide this systems analysis. Using three general categories of munitions, the model captures the impact of varying quantities of munitions manpower, transportation equipment, and storage capacity on achieved sortie rate. The model was designed for maximum analytical flexibility, and procedures are described that allow users to easily change the key variables in the model. Results from test simulations are analyzed to show the wide range of available output products and the procedures for using these displays.

A detailed description is provided for the model data base, which is appended to the report. Samples of simulation results are included along with an example of the input data used to construct the buildup networks. The report concludes with a discussion of the support structure for the LCOM that enhances its selection as an analytical tool to assist munitions planners.

AN EVALUATION OF THE SUITABILITY OF LCOM FOR MODELING THE BASE-LEVEL MUNITIONS PRODUCTION PROCESS

I. The Research Problem

Introduction

The increased emphasis within the Air Force to insure the readiness of its combat forces requires management tools that can accurately determine the logistics resources required to support planned wartime scenarios. One such tool, the Logistics Composite Model (LCOM), has been used by the Tactical Air Forces since 1971 to determine the maintenance manpower requirements for their major weapons systems. (1:1) As the manpower community has been the principal user of the model, the majority of improvements in LCOM software design and analytical applications have been made to enhance that manpower determination process. So narrow a focus, however, has not taken full advantage of the powerful analytical capabilities inherent in the model. The Rand Corporation, in their original design of the LCOM, included features capable of modeling not only the manpower resource but also the other main logistics factors (equipment and spare parts) required to support aircraft sortie generation at the base level. For the wartime scenario, munitions production is a critical leg of that logistics support. There has been relatively little

effort, however, to study the resources required to support munitions production, particularly from a systems analysis perspective. The basic purpose of this research is to correct this deficiency by building a generalized LCOM model of the munitions production environment. This model will demonstrate the capability of the LCOM methodology to analyze munitions support resource requirements.

This first chapter will discuss several aspects of the research problem. Included is a description of the project as defined by the Air Force Logistics Management Center (AFLMC), which is sponsoring this effort, and a brief look at munitions support analyses to date, including a synopsis of previous LCOM efforts. A detailed definition of the research problem will then be presented, to include a description of the intended users and uses of the munitions model. The concluding section of this chapter outlines the criteria that will be used to evaluate the suitability of the demonstration model.

Chapter II will discuss in detail the environment that was simulated in the research effort. The base level munitions "system" will first be described using a generalized conceptual model. Each stage of this general model will be expanded to describe the pertinent features that must be included in any analysis if a complete and accurate determination of munitions support resources is to be accomplished. The expansion will include a definition of specific resources that impact munitions buildup and their relationship to the work processes of generating munitions. The present methods of actuating munitions

buildup, controlling inventory levels, and distributing finished ordnance will also be discussed.

Chapter III will describe how the information detailed in Chapter II was translated into a computer simulation model. A basic discussion of the LCOM will be presented to enable the reader to interpret the network data base contained in Appendix A. A description of several of the output products available in the LCOM system will give the reader an appreciation for the wide range of analytical uses for the model and will help in nderstanding the trial simulation data shown in Appendix B. The intention is not to give a complete description of the LCOM nor to make the reader an expert in its use. Rather, it is intended to give a sufficient background with which to judge the model's application in analyzing the conventional munitions environment. Following this introduction, a detailed description of the model as applied to the munitions production is given. Complete details of the munitions generation and consumption routines, buildup trigger mechanisms and other aspects of the model are discussed, including a summation of the major assumptions used during model development. User procedures for changing various parameter values within the model are also described. The effect of these parameter changes are demonstrated in the next chapter.

Chapter IV presents the results of the simulations run using the munitions model. Because the purpose of this research is to demonstrate the universal suitability of LCOM, the simulations were based on a hypothetical scenario rather than a specific

scenario drawn from actual operational plans. Using a representative squadron size and target sortie rate, an initial simulation was made with unconstrained resources to establish a baseline sortie rate and initial resource demands. Subsequent simulation results are then presented that show the impact of constrained resources on sortie generation and how iterative runs of this nature can be used to determine a given mix of resource requirements. Following this discussion of simulation results, details pertinent to evaluating the model other than those explicitly contained within the model are discussed. Such details include computer run time, core usage, available compiler compatibility and representative simulation execution time. The final section outlines the data requirements that must be satisfied before the model can be used operationally within the Air Force to determine realistic resource requirements.

The final chapter discusses the conclusions and recommendatio reached during the course of the research effort. The first section evaluates the model according to the criteria established in Chapter I, concluding with an overall assesment of the suitability of LCOM for modeling munitions production. The last section presents recommendations in two areas. The first area is that concerned with the continuing development and exploration of the demonstration model should LCOM be chosen as the modeling methodology. The second area deals with the LCOM software itself and suggests several enhancements to improve the utility and flexibility the LCOM as a general analytical tool.

Given this outline of the research effort, we can now address the specifics of the munitions modeling project by discussing the background and original definition of the problem.

Background

The author originally encountered the problem of determining munitions support resource requirements while working as a manpower analyst at Tactical Air Command Headquarters in 1976. At that time, AFR 66-1 was the governing regulation for the organization and policies covering aircraft maintenance. This regulation designated a separate Munitions Maintenance Squadron (MMS) to control all munitions functions and support assets. (2: 2-9). Because of this organizational separation, the manpower resource requirements for the MMS were not determined using the LCOM as were the majority of manpower requirements for the other three squadrons more directly involved in aircraft maintenance. Preliminary attempts to extend the LCOM to cover the Weapons Loading function were made during the A-10 and F-4E LCOM studies completed in the summer of 1976. The results of these attempts, however, proved unreliable and were not forwarded to Hq USAF as valid requirements. Thus, manpower requirements continued to be determined by the conventional manpower methods specified in AFR 25-5. In essense, these methods gather historical data from base level, peacetime operations, then reduce that data via standard statistical regression techniques to a program estimating equation. (3:1-1) The wartime requirements are then extrapolated from these equations. Upon approval by HQ USAF, this equation becomes a manpower standard

and is entered in AFR 26-3. The current equations for the conventional munitions maintenance work centers for a wing maintenance organization are functions of the number of Primary Authorized Aircraft to be supported (4:2).

The shortfalls of this conventional method are obvious. First, the extrapolation to wartime conditions is difficult to justify, given the dissimilarity of the two environments. Munitions functions in peacetime are largely concerned with the processing of dummy ordnance, inspection of live munitions in storage, and personnel training. These functions support peacetime training missions which for economic, safety and training reasons, seldom carry live ordnance and rarely operate at sortie rates as high as those specified in wartime scenarios. Wartime munitions processing, on the other hand, is concerned primarily with the assembly, delivery and upload of live ordnance in support of missions whose sole objective is to "put bombs on target." Thus the wartime munitions operation differs significantly from the peacetime in the tasks performed, the type and quantity of munitions processed and the objective to be supported. Extrapolating wartime requirements solely from an equation derived from peacetime operations is a questionable practice at best.

The second shortfall of the conventional method lies in the nature of the program estimating equation itself. Based primarily on the quantity of aircraft to be supported, the equation does not account for the type of aircraft nor for the various sortie rates that each type is tasked to fly. Thus, an A-10, F-111A or an F-15 squadron of 24 aircraft each earns the same munitions manpower,

even though each weapon system carries different types of munitions, has different probabilities of expending these munitions and is tasked to fly a different sortie rate.

From this brief description, it is evident that a more rigorous and defensible methodology is needed to determine wartime munitions manpower requirements. The same need exists regarding the determination of other munitions support requirements such as transportation equipment (trucks and trailers), handling equipment (fork lifts and production stands) and facilities (storage, holding and buildup areas). Requirements in these first two areas are currently contained in the Table of Allowances (TA) for the various weapons systems, specified by aircraft type and PAA per unit. The quantities contained in the TAs are questionable for reasons similar to those regarding manpower requirements. The TA authorizations are determined through a negotiating process that combines the estimates of experienced munitions personnel with a qualitative assessment of the operational environment. This method makes it difficult to provide quantitative evidence that the requirements can actually support the wartime operations of a given weapons system and is largely unresponsive to periodic changes in that scenario.

Thus, there exists a need for a methodology that provides a systems view of the munitions processing function and that can be used to determine support requirements for any given wartime scenario. This need has been articulated throughout the Air Force and is the primary motivation for this research effort.

Current Modeling Efforts

There are at present two main avenues being pursued within the Air Force to provide the needed methodology. The first is the analytical efforts of the logistics and plans directorates at HQ TAC and PACAF. At HQ TAC, the major revision of the aircraft maintenance organization directed by AFR 66-5 provided the impetus to broaden the scope of the LCOM to include munitions maintenance manpower. Under AFR 66-5, the old MMS was disbanded and its various functional entities incorporated in either the Aircraft Generation Squadron (AGS) or the Equipment Maintenance Squadron (EMS). (5:1-1) As the munitions functions were made an integral part of the aircraft maintenance complex, it was logical to try to determine the manpower requirements using the same analytical method. The procedures for this analysis are contained in a technical paper written at HQ TAC in the fall of 1980. (6) Although these procedures have been used in several subsequent LCOM studies, they were developed to fill a gap in the manpower determination process and thus focus primarily on the munitions manpower resources alluded to earlier. With certain modifications, these same procedures have been used by HQ TAC/LGX in a study of the sortie generation capability of deployment packages in support of the Rapid Deployment Force. (7:17) HQ PACAF has also pursued independent efforts to model munitions functions. One effort parallels that of the Manpower Plans Division of HQ TAC/XP, in that it extends the scope of the LCOM.

The second avenue being pursued to develop an analytical tool is that taken by the Operations Analysis Directorate at HQ PACAF.

This organization is developing a new simulation model utilizing the GASP simulation language. Although only in the development stage, the model offers an alternative to LCOM. Its applicability to the munitions environment is being examined by project officers at the Logistics Management Center (LMC) located at Gunter AFS, AL.

Each of these analytical efforts was undertaken to satisfy the operational requirements of the parent organization. As such, they focus on the specific area of responsibility of that organization and often incorporate situations unique to the individual command. This lack of generality and the incomplete system perspective were the main reasons the Logisitics Management Center became involved in the munitions analysis effort. During the course of Mission Area Analysis in support of the Air Force Planning Guide, HQ USAF/LEYWC identified the deficiencies in the munitions capabilities analysis that have been outlined above. They contacted the LMC and recommended the initiation of a project to correct this problem. (8) After preliminary research, the LMC had narrowed and defined the problem sufficiently to establish Project #781040 (Appendix D). The objective of this project, as stated in the project plan, is to:

> "Develop a methodology to determine the effect of changes in munitions support resources on sortie generation. Any methodology developed must be able to:
>
> a. Determine the alternative mixes of resources . . . capable of supporting a given sortie rate.
>
> b. Determine the effects on sortie support of changes in one or more resource levels.
>
> c. Identify production bottlenecks caused by insufficient resources." (See page D1)

In addition to this broad objective statement, the LMC also concluded that computer simulation was the best approach to pursue because of the complexity of the munitions support environment. Subsequent investigation of work being done in the field narrowed the candidates for investigation to the LCOM and the HQ PACAF GASP model. The project officer also left open the option of developing an entirely new model should the LCOM or GASP models prove inadequate to the analysis effort. After initial familiarization with the language of the two alternative models, the LMC proceeded to define the specific criteria to be met by the simulation model and by which the two competing candidates would be judged. It is at this point in the progress of the project that this researcher became involved.

Based on my past experience with the LCOM and on the requirement for a munitions analysis tool, this research effort is aimed at producing and evaluating a demonstration LCOM model that the LMC can use pursuant to recommending a methodology capable of being used Air Force wide to study the munitions environment. As the LMC is the focal point in the Air Force to promulgate universal methodologies of this nature, the research effort was shaped to fit into the construct of their Project Plan. The limitations and direction provided by this plan are outlined below under the details of the problem statement.

PROBLEM STATEMENT

From the information provided above, the objective of the research is straightforward: to construct an LCOM simulation model of the munitions environment and exercise that model to

demonstrate its applicability as an analytical methodology useful to munitions managers and planners. Limitations imposed both by the LMC Project Plan and by available resources narrowed the scope of the research from that implied by this objective statement.

The first limitations discussed will be those imposed by the Project Plan. A complete picture of the munitions environment would begin with procurement from industrial sources and carry through to the delivery to the using weapon system. The LMC chose to narrow the system to be studied to that which occurs at the local base where the using weapon system is deployed. Thus, the overall process to be modeled will encompass the arrival of munitions at the base, up to and including loading the munitions on an aircraft. Furthermore, during this phase of the project, the plan has directed that modeling efforts be concentrated on the munitions buildup process within the base level munitions organization. This direction, however, is really more a degree of concentration than an exclusion of the other facets of the base processes, because additional criteria require that any model be capable of easy expansion to include the munitions processes other than buildup. Thus, the project plan has limited the scope of the model to a base level munitions system which concentrates on the buildup portion of the entire process.

Within these limitations, further constraints have been imposed on the modeling effort, partly because of the requirement to demonstrate the universal applicability of the model and partly because of the author's personal time constraints. The first of these constraints concerns the type of munitions treated

in the model. If one looks at the complete range of various weapons carried by a particular aircraft, then sums these weapons over the number of different aircraft in the current operating inventory of the Air Force, the array of munitions is not only impressive but quite large. This array can be substantially reduced, however, if the munitions are grouped according to common buildup characteristics. To this end, the model utilizes only three major groups of munitions, illustrated in the networks by a specific munition type selected from each category. Limiting the model in this way does not degrade the overall research effort because the techniques for capturing the support resource relationships are adequately demonstrated using these three categories. All that need be done, if and when the model is used to study a specific weapon system, is to insert the details pertinent to that system in the framework established by this generalized model. Details of the characteristics of the three munitions categories and of the munitions types selected from each category are contained in the next chapter.

The second of the constraints concerns the accuracy of the data used for various parameters throughout the model. These parameters deal primarily with the reliability and maintainability values of support equipment and the process times for various tasks within the model. To some degree, valid data is available for these parameters, derived primarily from previous efforts by this researcher while at HQ TAC and by members of the LMC during preliminary work on the project. Where such data is usable, it will be incorporated in the model.

It is beyond the scope of this research effort, however, to supply accurate parameter data where it does not already exist. In these instances, hypothetical values will be used. Limiting the model in this way is a natural consequence of the purpose for which it is being built; i.e., to demonstrate the LCOM capability.

Thus, the emphasis in treating various parameters is not on their numerical value but rather on the terms in which they are expressed. For example, the frequency with which a fork lift malfunctions is not as important in the context of this research as is the way it fails in relation to its use within the munitions buildup process. That is, can the relationship among the various support resources best be captured by expressing failure as a function of number of operating hours, by calendar days, or number of munitions processed, etc.? The value of the parameter is subject to change; indeed, the function of the model is to capture the impact of that change. The terms in which the parameters are expressed, however, are not subject to change. They should be expressed in terms that best capture their relationship to the overall process. Specific details regarding parameter terms are contained in Chapter III and some general observations regarding data collection and validation are discussed in the final portions of Chapter IV.

To summarize, then, the modeling efforts contained in this research are directed toward the base level munitions process with particular emphasis placed on the buildup section of that process. Data values within the model's networks are represen-

tative in nature; their quantitative validity being of less importance than the terms in which they are expressed.

Intended Users

Given the scope and limiations of the model just described, a few comments regarding its intended use will assist the reader in understanding the approach that was taken in representing the real world of munitions processing in a simulation model. The first of these comments regards the organizational level at which the model can most practically be employed. The LCOM Main Module object deck is a sophisticated and complex software package and requires a relatively large amount of Central Processing Unit (CPU) storage space. When the core requirements for the simulation model are added to this requirement, the result is such that only computer resources available at Major Command level or higher can process an LCOM simulation. In addition, the simulation execution time, while dependent on the size of the specific model, will generally be greater than that available to any one office or organization below MAJCOM level. For these two reasons, (core and execution time requirements), the model will not be of much practical use below MAJCOM level.

The second comment regarding intended use concerns the question of whether the model is to be designed to determine future resource requirements in support of a planned scenario or to assess current operational capabilities given current, on-hand assets. At first the distinction may appear so slight as to be purely academic. One need only investigate the present

discrepancies between authorized assets and on-hand balances and the creative management techniques that exist throughout the Air Force to deal with these differences to realize that the distinction is not academic. The munitions model in this research paper was developed for the determination process. Certain assumptions were made regarding equipment usage, production processing and inventory control that are not always valid in the real world because of the shortages mentioned above. Where possible, these assumptions were associated with particular model parameters that can be changed by the user so that some assessment of the effect of the assumptions can be made. In other cases, the assumptions are hard wired in the logic of the model and, as such, limit its applicability in the operational ssessment role.

With this understanding of the scope of the model to be developed and its intended uses, the concluding section provides the criteria against which the final model will be evaluated.

Evaluation Criteria

From the basic objectives of the LMC Project Plan stated earlier, it is obvious that the focus of the model is on the resources involved in munitions production. The following criteria are generated primarily from this focus.

Criterion 1: The model must capture the utilization and interaction of all pertinent resources involved in the munitions production process. It must address operations where any or all of these resources are limited in quantity, whether from

externally imposed initial constraints or from internal resource utilization during simulation.

Criterion 2: The model must show, either directly from simulation results or indirectly through subsequent calculations using simulation results, the impact of limited resources on sortie generation. Simulation results should show where bottlenecks occur in the production process and what resources are responsible for them.

Criterion 3: The model must be capable of handling the simultaneous production of several munition types, each competing for the use of the same resource.

Criterion 4: The modeling methodology must be capable of simulating the range of production processes used for the current inventory of munitions in the Air Force.

Criterion 5: To be a useful management tool, the parameters and variables in the model must be easily changed by the user to reflect different opeations scenarios and munitions management policies.

Criterion 6: Although the scope of this research does not encompass munitions receipt/storage or aircraft loading, the model must be capable of expansion to include these areas and of relating this complete munitions processing system to sortie generation.

Criterion 7: The data used in the model should be that which is currently available to the user or that which could reasonably be obtained from current Air Force data collection systems.

Criterion 8: The computer requirements and supporting software packages required by the model should be compatible with computer hardware currently available at MAJCOM level or higher.

The above eight criteria, although general in nature, provide a framework of design for a model which will be useful to the MAJCOMs concerned with munitions production resources. Prototype models submitted to the LMC for evaluation can be compared using these basic criteria as an initial selection screen. With that initial screening, systems analysts and munitions managers will be able to expand the criteria to provide more detailed guidelines for further model development and evaluation.

In summary, the material contained in this chapter was intended to lay a foundation for the remainder of the research effort and to channel the reader's expectations regarding the munitions model that is its output. The following chapter will continue to build on that foundation by describing the munitions environment that is represented by this model.

II. Simulation Environment

Conceptual Model

Chapter I established the scope of the modeling effort and explained the emphasis on the munitions buildup process. Before presenting the details of this process, however, it is necessary to discuss how buildup relates to the remaining functions in the base level munitions systems. The conceptual model in Figure 1 diagrams that system in adequate detail to show these interrelationships.

One of the first things to note in the model is that the processes, shown in blocks, are tied together by the consumption and generation of specific end items. That is, the storage process generates the bits and pieces that are consumed by the buildup function, which in turn assembles these parts and generates a complete munition. These complete rounds are then loaded on the aircraft for eventual "consumption" during a sortie. Obviously, any slow down or outright stoppage of production in one function will have certain effects on the production rate for a subsequent functions. The LCOM is particularly well suited to simulate a system linked by sequential production because a major part of its software is devoted to tracking and accounting for parts that are generated and/or consumed. This compatibility was one of the initial reasons that suggested LCOM as a useful methodology to simulate the munitions environment.

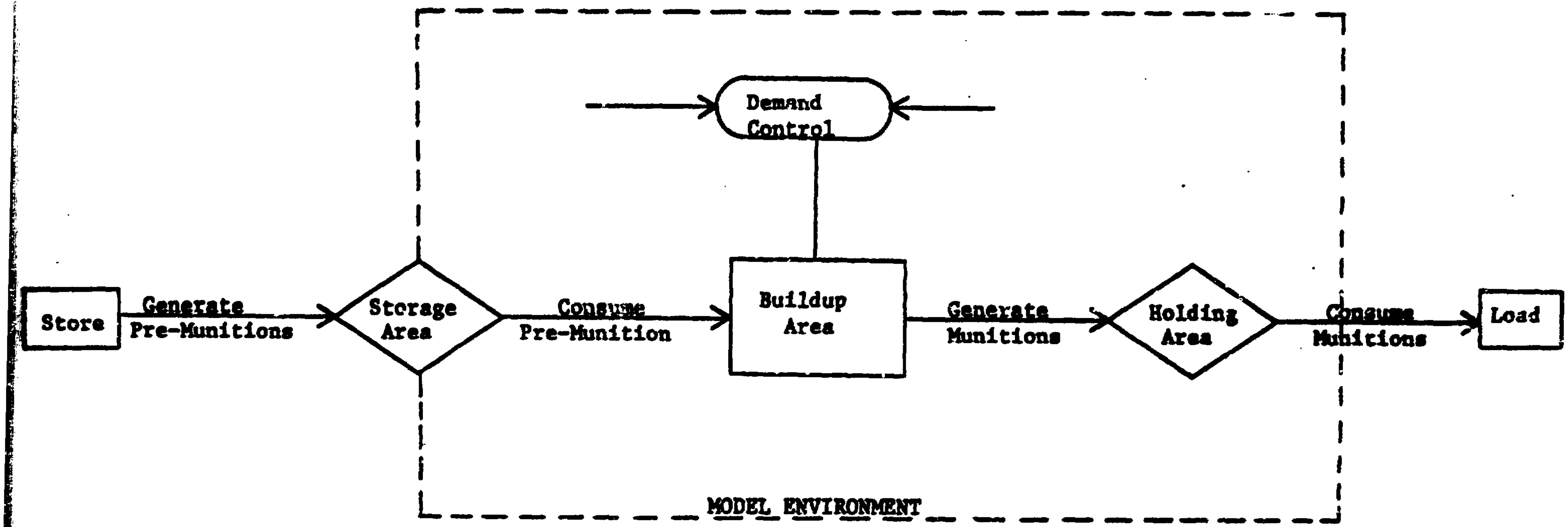

Figure 1. Conceptual Model

A second feature to note in the conceptual model is the final consumption of munitions by loading on an aircraft. In this function lies the key parameter that reflects overall system performance and which is, therefore, the best independent variable to measure the adequacy of various levels of munitions support resources. Certainly it is possible to select an intermediate measurement parameter that would reflect system performance at selected points throughout the process. One such parameter, for instance, might be a buildup production rate, expressed in number of bombs produced per hour. Yet any such intermediate measure would then have to be related to the overall goal of the munitions system, which is to provide the required munitions for wartime sorties. To avoid the problems posed by intermediate measures of performance, any simulation should be capable f modeling a detailed wartime scenario and must directly link aircraft processing in that scenario to munitions production. The LCOM has both of these features, the latter through the consumption logic previously mentioned. The details of reproducing a specific scenario are beyond this research effort, whose purpose is to build a general model. However, the procedures for building the scenario are well established. AFR 25-8 has a detailed questionnaire for gathering scenario data (9:4) and the procedures for translating that data into computer language are contained in a HQ TAC/XPM technical paper. (10) The fact that such procedures are established and are being used, however, is one of the primary reasons for using LCOM to study munitions production. This feature will allow the analyst to use

sortie generation as a direct measure of the adequacy of support resource requirements. This capability produces credible and defensible requirements and is the main feature supporting the use of LCOM for this analysis.

The third and final characteristic of the munitions system illustrated by the conceptual model is the block labeled Demand Control. This block represents the inputs that are used in the field to arrive at the decision to start munitions buildup and to determine the quantity to be built. As shown, the system operates by responding to demands from the final consumer -- the aircraft loading function. In supply terminology, the system runs under a "pull" demand rather than a "push" supply philosophy. This is accomplished by looking at the projected flying schedule and ordering munitions production based on that plan. The period of projection and subsequent buildup is a function of several variables which are discussed in detail later in the chapter. The "pull" nature of the system is modified to some extent by the input of actual sortie consumption to the demand control process. This is essentially a feedback loop which allows the munitions managers to weigh scheduled sortie munitions requirements against actual consumption. Discrepancies between the two may cause changes in the production order. Thus, any simulation model must be able to look ahead at the scheduled scenario and account for actual consumption and must use this information in an internal feedback loop to dynamically change production start-up during the simulation. The techniques used in this LCOM model to satisfy these requirements are described in Chapter III.

To summarize, the conceptual model highlights several general system characteristics which should be captured by a representative simulation model. The first of these is a production process that is triggered by sortie demand, with each step of the process dependent upon the output of the previous step. The second is that sortie generation is the most direct and valid parameter with which to measure the adequacy of munitions support resources. Any analytical model must, as a minimum, capture these two elements of the munitions system. Within these general guidelines, it is now possible to describe the more specific details of the buildup sub-function.

Munitions Buildup.

Because of the emphasis of this paper on the buildup function, the specifics of how unassembled munitions are ordered and arrive at the base and how they are inspected and placed in the storge area will not be presented. The process that will be modeled starts with the withdrawal of a certain quantity of these munitions parts from the storage area for delivery to the buildup function. The stored parts are broken out of their containers or pallets and loaded on transport vehicles for delivery to buildup in multiples of common storage lot sizes. For certain munitions, the common lot sizes for the various components may not all be of the same quantity. For instance, the number of tail fins in a standard storage container is usually greater than the number of bombs on a storage pallet. Thus, delivery to the buildup area may not always be in a one-to-one ratio for all parts required for final assembly. The transportation and accounting of

mismatched storage lot sizes will be described in Chapter III.

One major limitation exists that restricts the quantity of any munition that may be placed in a single location. Each munition is assigned a value in explosive weight based on its explosive potential. To satisfy safety precautions, any physical location is rated as to the total or Net Explosive Weight (NEW) that can be positioned there at any one time. Before unassembled munitions can be delivered to a buildup area, a check is made of available NEW in the area. Insufficient NEW capacity may delay the delivery of parts from the storage area.

When all the required parts are assembled, the actual buildup can begin. Depending on the specific munition type, this may involve any one or all of the following tasks: parts or whole round inspection, guidance control checkout, fuse assembly, and buildup or linking on ammunition belts. When the required tasks are completed, a finished munition is loaded on the appropriate transportation vehicle, ready for delivery to the holding area. Again, the holding areas are rated by NEW and a sufficient capacity must exist there before the buildup area can be cleared of assembled munitions. From the holding area, the required munitions are transported on demand to the flight line for upload on the aircraft. Certain operational requirements or physical limitations may cause deviations from the process just described. For example, combat quick turn procedures have been developed in which aircraft are taxied to a munitions holding area. This eliminates the need to transport munitions from a holding area to individual aircraft revetments. In another case, munitions are

delivered directly from the buildup area to aircraft parking areas, thus eliminating the need for an intermediate holding area. The simulation model should be flexible enough to represent these different situations.

As already mentioned, the rate of production is controlled to some extent by the available NEW at various physical locations. In reality, this is not a critical limitation because, in contingencies, almost any open area on a base can be designated for weapons deposit. Thus, total NEW can usually be expanded to match the system requirements. The primary production control is exercised by the munitions staff organization and is based on scenario requirements. Normally, the flying schedule is published 24 hours in advance. The aggregate munitions requirements are determined from this document and appropriate buildup orders are placed. To handle deviations from the planned schedule, a certain stock level of assembled munitions is also maintained. This level must be great enough to permit operational flexibility to change sortie munition loads but is practically restricted by holding-area NEW and vehicle resources. Thus, buildup decisions are made after considering the planned consumption, current inventory level, desired safety stock level, holding area limitations and equipment availability. The interplay among these factors is complex and should be reflected in any simulation of the munitions environment.

Munitions Buildup Categories

The preceding paragraphs have explained the flow of munitions from the storage area to the aircraft and have outlined

the considerations that control that flow. This framework is common to most all the various munitions in the current inventory. The only major difference occurs in the actual buildup procedures and in the support resources required to process each munition type. To describe the buildup procedures for all munitions types is not the purpose of this research. The applicability of the model can be maintained, however, by grouping munitions by common buildup procedures and including a representative munition from each category in the model data base. To this end the author has derived the following three categories: 1) assembled munitions, 2) all-up rounds and 3) ammunition. By modeling a munition from each category, the research demonstrates the procedures that can be used to simulate any of the various munition types that may be called for by a particular wartime scenario. The following sections explain each category and indicate the munition type contained in the model.

Assembled Munitions. This category includes all those munitions that are produced by assembling various component parts at the deployed location. The buildup starts with delivery of the required components to a central assembly location, where they are inspected, then put together to produce the completed round. Munitions in this category generally have the more extensive assembly procedures and are often produced using an assembly line operation. The majority of conventional weapons fall into this group, which includes the MK82, 83, and 84 General Purpose Bombs, the AIM-9 Sidewinder air-to-air missile and the AGM-65 Shrike air-to-ground missile. The MK82 bomb was

included in the simulation model for several reasons. First, it gives a good representation of the complex assembly procedures common to this category. Second, the general purpose bomb is a common munition specified in scenarios for aircraft with an air-to-ground mission. Last, reasonably accurate data has been collected by the LMC for the MK82. The MK82 buildup flow diagram and corresponding resource requirements, as gathered by the LMC, are contained in Appendix C. Reference to this data will be made in the next chapter and also in Chapter IV in the data discussion section.

All-up Round. This category represents a recent advance in munitions production that was introduced to simplify and reduce the munitions support requirements at base level. Essentially, the assembly has been accomplished prior to munitions delivery to the base. The base process, therefore, is primarily that of inspection of the round in its container and delivery to the using aircraft. Munitions in this category include certain air-to-air missles like the AIM-7 and cluster munitions such as the MK20 antitank weapon. The AIM-9 was chosen for inclusion in the model. One reason for its selection was the opportunity to study the impact of a munition that is available both as an all-up round and as an assembled munition. The capability to make such a comparison suggests one of the various uses for the simulation model.

Ammunition. This category encompasses all rounds that are fired from the variety of guns installed on Air Force aircraft. It includes such munitions as the 20mm and 30mm machine gun

ammunition and the 105mm cannon rounds. The buildup procedure consists, in general, of round inspection, linking rounds in a carrying belt and loading the belt in an aircraft loading device. The 20mm round was simulated as it is the round carried by the majority of active inventory aircraft. The data for the buildup networks was collected by the LMC.

Buildup Resource Requirements

Once the reader is familiar with the LCOM procedures and with the model data base at Appendix A, he will be able to determine the exact resources for any particular task in the buildup process of a specific munition. Some general comments regarding the various resources will aid in that learning process.

Manpower. The manhours and resultant manpower requirements that can be derived from simulation results reflect only direct productive labor. No attempt was made to model supervisory or management positions, primarily because these requirements are not a direct function of the sorties to be supported. The majority of direct production work in the munitions function is performed by personnel with the 461XX Air Force Speciality Code (AFSC). Various personnel within this AFSC are assigned to specific work centers within the munitions complex. In the model, only two major distinctions were made in the 461XX resource. The first was between those personnel assigned to store and deliver unassembled munitions and those assigned to buildup and deliver munitions to the flightline. This division

represents two distinct pools of manpower, and cross-utilization between them does not occur in the model. Within each category, a further breakdown was made between qualified and assistant resources. This was done as it is common to supplement the munitions buildup personnel with minimally trained augmentees during contingency operations. The qualified personnel were allowed to substitute for the augmentees but not the reverse. This technique will allow planners to assess the degree of augmentation required to support any specific scenario.

Facilities. In researching the constraints that phsyical sites (holding, storage and buildup areas) place on munitions production, the author discovered that rarely are physical dimensions a limiting factor in positioning munitions. Rather, it is the total explosive potential that can be co-located in an area that establishes such limits. Thus, the capacity of a facility is expressed in Net Explosive Weight units so that the impact of limited facilities on sortie production can be analyzed.

Equipment. The various pieces of equipment contained in the model reflect the specific requirements of the three munitions types selected. As such, they do not comprise a comprehensive list of all the equipment associated with munitions processing. Where acceptable according to regulation or common practice, substitution was allowed between comparable pieces of equipment; the 4000, 6000 and 10,000 pound fork lifts were all made interchangeable. Availability of the various equipment is restricted by sending them through repair and maintenance networks.

These networks represent both scheduled and unscheduled maintenance and were included to illustrate how equipment reliability and maintainability is treated in the simulation.

Summary

The content of this chapter was designed to familiarize the reader with the system being simulated. It detailed the sequential flow through the various munitions functions, discussed the buildup control function and highlighted the emphasis that will be placed on sortie generation as the prime measurement of support resource capability. The description of munitions buildup categories and preliminary discussion of resource characteristics were included to aid the reader in understanding the following model description in the next chapter.

III. Model Development

LCOM Background

The Logistics Composite Model was designed by the Rand Corporation in response to a request from the Air Force Logistics Command (AFLC) for a methodology with which to study base level logistics functions. Subsequently, the Human Resources Laboratory at Wright-Patterson AFB began exploring the capabilities of the model as a tool to determine maintenance manpower resources for new aircraft weapons systems. This organization was responsible for the first comprehensive use and documentation of LCOM as an analytical methodology. In 1971 the Tactical Air Command tested the LCOM as an alternative to determine manpower requirements for its operational aircraft. (1:1-1) The pilot study at TAC modeled wartime operations of the F-4E. A field validation at Seymour-Johnson AFB (11:A-1) proved the validity of LCOM results and the Air Staff authorized use of the model as the primary method of determining maintenance manpower resources.

LCOM Infrastructure

Since that validation, the model has found widespread use throughout the Air Force and has generated its own extensive

support structure. The manpower planning organizations at HQ TAC, PACAF, USAFE and, more recently, MAC and SAC have an established LCOM capability. In addition, the Air Force Test and Evaluation Center has used the model in logistics support analyses of new weapons systems. The Aerospace Systems Division at Wright-Patterson AFB has also used the LCOM in support of research and development projects. This growing community of users has generated two important spin-offs.

First, these organizations have produced a cadre of trained personnel, expert in the use of the LCOM and familiar with its analytical capabilities. Second, a central support organizaiton, the Air Force Maintenance and Supply Management Engineering Team (AFMSMET), serves as a focal point for maintenance of the model. The AFMSMET has developed and continually updates the software and user documentation for the LCOM. They disseminate improved versions of the model and, through the LCOM Steering Group, collect user inputs for future enhancements. The Steering Group meetings provide an excellent forum where new applications can be surfaced and where users can exchange technical ideas and analytical procedures. In addition, the AFMSMET also maintains the LCOM Student Training Text. (12) This document is invaluable in introducing the basic principles of constructing an LCOM model and, together with the User's Guide, provides the information necessary to train new personnel in the LCOM methodology.

The AFMSMET also serves as an approval agency for LCOM studies, providing guidance in report standardization and quality control. This diverse range of users and support organizations

is a major indicator of the accepted analytical utility of LCOM in the Air Force. Starting with personnel training and continuing through model enhancement, this structure adds an important dimension to be considered when comparing LCOM to other simulation models.

General LCOM Description

Looking now at the actual model, the LCOM software can be viewed as an interconnected system of four basis modules. These modules work together as a complete unit to simulate base level logistics functions. The brief descriptions of these modules that follow are essentially summaries of the detailed descriptions contained in AFMSMET Report 78-5.1. (1:2-17 - 2-20) The reader who is interested in a more complete description of the LCOM software and simulation techniques than is contained in this chapter is strongly urged to consult the referenced document. It is a comprehensive user's guide to the LCOM. With that direction in mind, the following discussion will provide an introductory familiarization with the LCOM and its functions, beginning with the Input Module.

Input Module. The Input Module is esentially a translation device. It allows the reader to enter data pertinent to the system being modeled via a series of easily understood forms. The Input Module translates that data into a binary computer format for processing by the Main Module. A comprehensive error and diagnostic message routine are also included in the Input Module. These allow the user to debug the data base prior to

attempting actual simulation, thus economizing on valuable computer time and usage. When all error checks have been passed, the Input Module produces a file called an initialization. The initialization is referenced by the Main Module during actual simulation. A second function of the Input Module is to produce the file of exogenous events that trigger activities to be processed through the data structure contained in the initialization. This exogenous file specifies the type of resource that will enter the data base and schedules the time and place of entry during the simulation. It is this feature of the LCOM that has made it so successful in simulating the details of a wartime scenario.

Main Module. As suggested in the preceding section, the Main Module conducts the actual simulation processing. Essentially, the initialized data base is a series of tasks connected in a representation of the flowpath of an entity through the environment being simulated. Each segment specifies the time and resources, by type and quantity, that are required to accomplish the task. When indicated by the exogenous file, the Main Module draws the specified entering resource from an internal pool. It then enters that resource at the appropriate point in the data base and begins the network processing. At each task, the Main Module checks the pools of required resources for availability and, when all specified resources are available, draws them from the pool for the length of the task. At the end of the task, all resources are returned to their proper pools and the entering resource is passed to the next task. All tasks are

processed in a similar fashion until the end of the network is reached. At this time, the entering resource is released back into the proper pool for subsequent processing. Simultaneous processing of a virtually unlimited number of resources is possible, and simulation continues until all exogenous events are processed or simulation stop time is reached, whichever occurs first. Provision is also made for the generation and/or consumption of resources throughout the simulation. During the simulation, statistics are fed to a separate file which is passed to the next module for use in a variety of processing reports, as selected by the user. In addition to these optional displays, the Main Module produces a standard summary of simulation results in an output called a Performance Summary Report (PSR). The PSR is separated into six categories of reports and offers summary statistics of simulation events. At the user's option, intermediate (level 1) reports can be produced for a subset of total simulation run time with an aggregate (level 2) report produced summarizing the complete simulation. For instance, if the simulation were run for 120 days, a level 1 PSR could be produced every day, and a final, level 2, PSR would present simulation results for the complete 120 days. The six categories in the PSR are: Operations, Aircraft, Personnel, Shop Repair, Supply, and Equipment. Within each category, the user defines the specific headings for which statistics will be displayed. There are a total of 76 statistical displays in the six PSR categories. The information in these displays can be seen in the simulation results at Appendix B. The display labels are self-explanatory.

In addition to the PSR reports, the user can select snapshot reports at any desired point in simulation time. These snapshots give the status of various aspects of the simulation at the requested time. From this brief description, it should be apparent that LCOM is capable of producing a full range of simulation output statistics. As the amount of detail is controlled by the user, the analyst can tailor these reports to any particular problem. For complete details on PSR output, the reader is encouraged to consult the AFMSMET Report referenced earlier.

Post Processor Module. This module produces additional displays of simulation results. The Matrix, Parts, Supply and Mission Post Processors are aggregate displays that show the utilization and processing of particular resources for the entire simulation period. The Graph Post Processor enables the user to produce graphical displays of selected statistics. The Display Post Processor traces an aircraft resource through all the various tasks it processed during a selected interval of simulation time. Its primary use is for debugging and validating the logic of the networks in the data base.

Restart Module. This model allows the user to stop the simulation and dump all statistics to a save tape to be used for restarting the simulation at a later date. It was not used for this project and has limited use throughout the LCOM community.

Summary. The preceding paragraphs have outlined the basic construction and function of the LCOM and have described the interface between the four modules that make up the complete model. Several of the output products described above for the

LCOM II SYSTEM

LCOM II SIMULATION SOFTWARE		
INPUT MODULE	**MAIN MODULE**	**POST PROCESSOR MODULE**
Includes: Data Verification Initialization (INIT) Process Scenario (EXOG) Generation Process Data Display Data Summarization	Includes: Simulation Process Simulation Reports Transaction Outputs **RESTART MODULE** Includes: Main Module Restart (HIS only)	Includes: Transaction Decoder Matrix Post Processor Graph Post Processor Parts Post Processor Display Post Processor Mission Post Processor Support Equipment PP Realized Flying Schedule

Figure 2. LCOM II SYSTEM STRUCTURE (1:2-2)

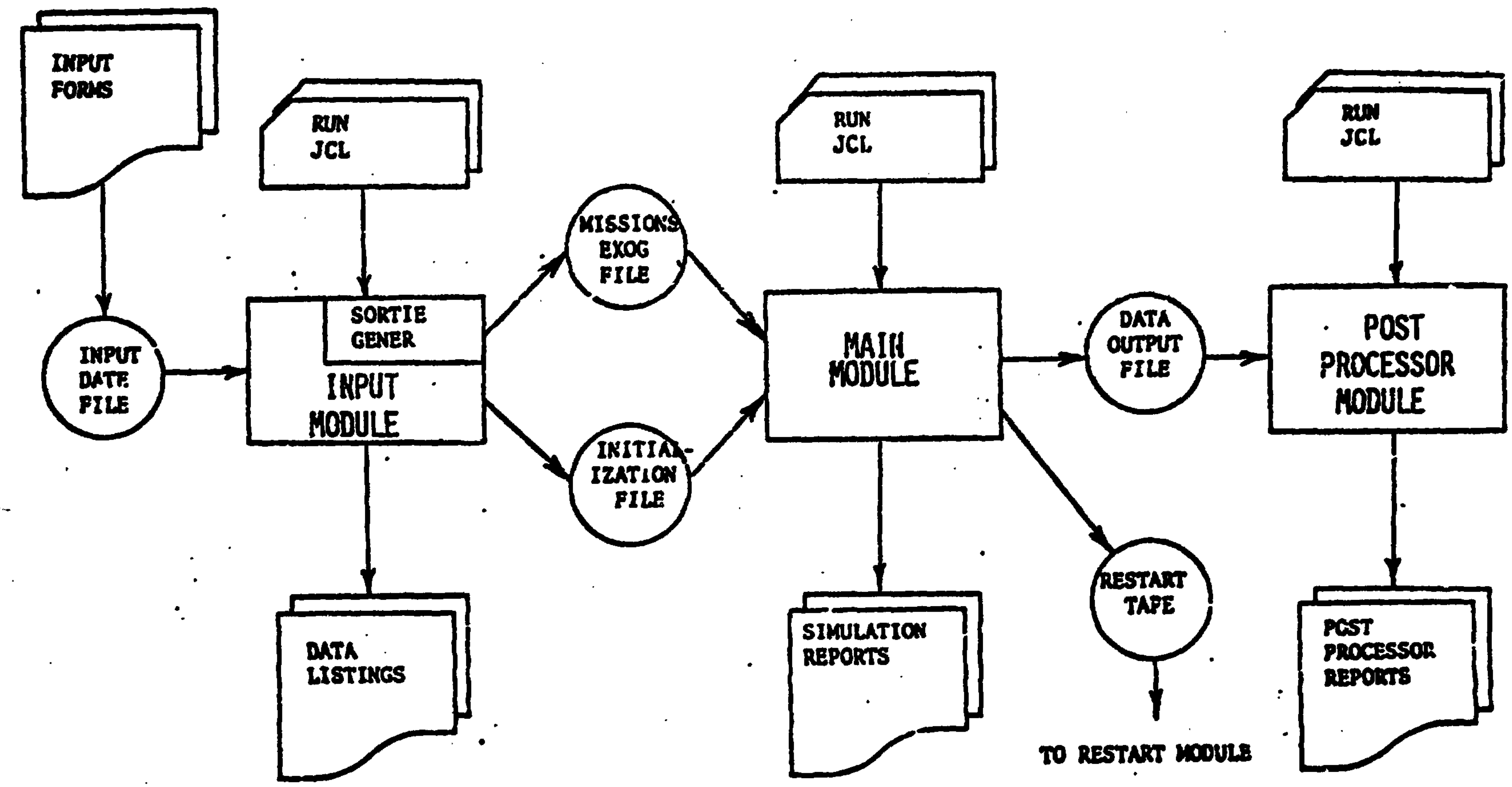

Figure 3. BASIC LCOM II SIMULATION SOFTWARE MODULE INTERFACES (1:2-3)

munitions model simulation are illustrated in Appendix B. Fig. 2 and Fig. 3 provide a summary of the above information. The next section will give a detailed description of the Munitions Model constructed for this research.

The Munitions Model

During the explanation of the Munitions Model, extensive reference will be made to the data base contained in Appendix A by keying various descriptions to the appropriate line numbers in that data base. The general scheme of explanation will use the network flow logic contained in the Form 11s which run from line number 466 to line number 842. For the information not contained in the Form 11, the reader will be referred to the appropriate line number in the remaining forms that comprise the rest of the data base. Before beginning, a brief explanation of the content of each Form will assist the reader in following the model explanation. The forms will be described in the same order in which they appear in Appendix A. The form number appears in columns 2 and 3 on each line of the individual forms.

Form 10 - contains the labels for the headings that appear in the PSR.

Form 13 - lists the various resources used in the model, segregated by the following codes: I for aircraft, M for manpower, P for parts and A for equipment. This form also contains the name and value of the failure clocks that control entry to the equipment repair networks and that control iterative generate tasks.

Form 12 - contains the name of each task in the network and defines the task time and resources required for the task. The consumption and generation of resources are also indicated on this form.

Form 11 - lays out the flow of entities as they are processed by the model. Format consists of a prior node name, the task performed when reaching that node and the name of the next node referenced when task processing is complete. The trace of information in this form is the basis of the model explanation.

Form 14 - contains the failure clocks, the tasks that cause each clock to be decremented to simulate equipment failure and the decrementing value that each clock will have subtracted from it when the specified task is performed.

Form 16 - specifies the shift lengths that the manpower resources will work and the initial quantity of manpower on each shift.

Form 17 - designates the entry point in the Form 11 for each of the exogenous events in the exogenous data. The form also defines the resource that will be processed through the networks.

This form definition should prove useful in understanding the following model explanation, which starts at the beginning of the Form 11s.

Main Flight Line Network. (line number 466 through 473) The six tasks in this section are representative of those that most aircraft must process during the course of a mission. This section is vitally important because it contains the consumption of munitions by loading on the aircraft. If for some reason (inadequate support resources or insufficient facilities), a munition is not in the available pool, aircraft processing will be delayed awaiting munitions production, and a corresponding degradation in sortie rate will result. It is this section that allows the analyst to directly relate support resource capability to sortie generation. The mechanics are as follows. Line 468 contains the task CQMUN. This is not an actual task, but is the name of a next node that the aircraft must go to. In LCOM terminology, this is a "called" node. It is a unique feature in LCOM and means that the aircraft must go to the specified node and complete all tasks or networks connected to that node before returning to the main networks to continue flight line processing. The actual consumption mechanics will be described in the next section. Two other items are of interest in the flight line networks. The first is the task labeled R at line 469. The R task is a mechanical device which allows the connected network to be processed but prevents the aircraft from being delayed during that processing. This is accomplished by placing an "*" in column 29 of the Form 12 defining the R task. See line 137.

In this case, the network following the R task is the munitions buildup network. This R task, which stops the aircraft from processing the connected network but triggers the munitions

buildup, is the munitions consumption feedback loop described in Chapter II. Thus, each time a sortie consumes or attempts to consume a given set of munitions, the control network to start munitions buildup is activated. If buildup decision criteria are met, munitions generation will commence. Notice also that the R task has the same prior node as the CQMUN task. The parallel noding allows buildup to occur when the munitions stock is depleted and the aircraft is awaiting subsequent munitions production. If the buildup trigger were referenced sequentially after the consumption call section and, if munitions had been reduced to zero, the aircraft would be delayed at the consume call task and would have to wait for buildup to be started by the next day's frag order before it could load and continue flight line processing. This is an unacceptable delay and would not reflect real world operations.

The second item of note in the flight line network is the continuous loop nature of the flowpath. That is, at the completion of the last network task (REFUEL), the aircraft is sent back to the beginning and immediately starts processing again. This is an artificial network devised solely for this demonstration model. Normally, a detailed wartime scenario would be contained in the exogenous file, defining a number of different types of sorties, each carrying a different munition load. In such a case, each mission would have a separate entry point to a unique flight line and and munitions loading network. As was explained earlier, this research does not attempt to model a specific scenario. Thus, for demonstration purposes, the

aircraft are processed by an activity which enters this closed network and continues to loop through it until simulation stop time is reached. By varying the length of the sortie task, any desired sortie rate can be modeled without having to build a new exogenous file or re-initialize the data base. User procedures for changing this task time are discussed in the last section of this chapter. The above technique facilitates the analysis of the munitions buildup process, yet still incororates the munitions consumption logic. This consumption logic will impact accomplished sortie rate exactly as it would if a wartime scenario were being used to initiate aircraft processing. This activity processing technique does require special interpretation of the output statistics to determine sortie rate, but the procedure is straightforward and will be explained in Chapter IV.

Munitions Consumption Networks. (lines 474 to 528) As mentioned in the preceding section, this series of networks is reached by processing a call task in the main flight line network. Notice that the consumption for all three munition types is attached to the CQMUN node: The MK82 at line 474, the 20MM at 679, and AIM9 at line 758. This logic simulates the simultaneous delivery of all three munitions to the loading area and requires all three munitions to be consumed before the call section is completed and the aircraft is returned to the flight line network. In the interest of brevity, only the MK82 consumption and buildup logic will be described from this point on. The other munitions networks are similar in nature, differing only in the number of tasks and specific resources for

each task. The connecting network logic and consume and generate routines are the same for all munitions.

The MK82 consumption network starts at line 474. Notice that there are three sets of prior nodes labeled CQMK82 (lines 475 to 479; lines 487 to 491, and lines 499 to 503), with each set containing five CQMK82 nodes. In effect, this scheme is checking each of five holding areas for the MK82 munition, which may be loaded on any one of three types of delivery trailers. The software logic that allows this search is triggered by the R selection mode, indicated by the R in column 26. For each task on an R selection mode, the model looks at all the required resources and ,if all are available, processes that and only that task. If any of the resources are not available, the model moves to the next task and repeats the search. This process continues until a task is selected or until the list of tasks attached to the common node is exhausted. In the latter case, the model moves back to the first task searched and back-orders the resources. A task name convention was employed that gives the reader an indication of what set of resources are being searched on each task. The convention keys on the last two characters in the task name. The penultimate character indicates the holding area (A-E). The last character indicates the type of trailer carrying the munition, where 1 equals a MHU12, a "2" a MHU85, and a "3" a MHU11. Thus, the task QM82A1 indicates the task that will consume a load of MK82 General Purpose bombs loaded on a MHU-12M trailer which is stored in holding area A. It must be emphasized that the task name is strictly a convention

for the user's convenience. The actual resources required for the task are listed on the Form 12. Referring to lines 142 to 144, the reader can confirm that the implied set of resources are in fact listed for this example.

Several other vital pieces of information are contained on the Form 12's. This information will be described using the same QM82A1 task as an example. The data will be described as it is encountered on the Form 12, reading from left to right. Immediately following the task name, are the numbers 2, indicating task type, and 1, indicating task priority. The task type is not important in this model. The priority is used by the model to assign resources to tasks which occur simultaneously or to arrange tasks in a back-order queue. The next field contains the task time, variance and distribution. In this case, the time (.3 hours) represents the travel time from the holding area to the loading area. This task has a lognormal distribution with a .1 hour variance. The model draws a unique task time from this defined distribution each time the task is referenced. This gives the model its stochastic properties. The next set of characters are the resources required to perform the task.

The first resource encountered is the M82A1, as suggested by the task name. Notice that the resource is followed by a "C" and the number 2. This tells the model to reduce the pool of M82A1 resources by two units. The MK82 resource, which is also consumed, is an information trigger whose use will be explained later. The last resource listed is a 461CQ in a quantity of 1. This indicates a manpower resource with a 461XX AFSC, who works in

the buildup and/or holding area (461CX), and who is fully qualified (461CQ) to accomplish the task. The next line on the Form 12 is merely a continuation of the required resources for the QM82A1 task. The first resource listed here is a 461CS. This manpower resource is the same as the 461CQ except it indicates minimally trained or augmentee resource. These categories of resources were explained in Chapter II. Notice that the 461CS resource is followed by an X. This indicates that an acceptable substitute has been specified for this resource on the Form 13 record. On line 22 in the Form 13s, one can see that a 461CQ can substitute for a 461CS. Thus, the preferred manpower combination is one qualified and one augmentee. An acceptable substitute, if no augmentee is available, would be two qualified personnel. This Form 12A (line 144) indicates this second resource combination and labels it RCS-1 to eliminate repetitive definition should it be used for a different task.

Returning to the Form 11s at line 480, the discussion of the consumption routine can be completed. Having processed one of the R selection mode tasks, the aircraft consumes one of the required munitions. This action also releases the holding area capacity. The CHOLDA call section (511) generates the proper quantity of the resource HOLDA, depending on the quantity of munitions consumed in the preceding task. The munitions are then loaded on the aircraft (LDMK82), which in turn releases the trailer resource. The CMHU12 call section (521) generates the proper quantity of the resource MHU12 in the same manner as the CHOLDA call section. This last generation completes the called

munition consumption section and releases the aircraft to continue its flightline processing.

Munitions Buildup Control. (lines 529 to 531) Recall that this section of network was reached by processing the R task in the flight line network, and that the aircraft was prevented from processing through that R task. The buildup decision logic is again constructed using the R selection mode feature. The first task encountered on the R modes in TMK81A. Referring to the Form 12 definition on line 197, this task requires 24 MK82 resources. If that quantity is available, the network ends. If 24 MK82's are not available, the paralled task (ENTER) is queried. Because this task requires no resources, it will always be processed if it is reached. In short, the control function says: if there are less than 24 MK82 assets on hand, send an order to the buildup function to begin production. The quantity of MK82's specified on the first R mode task is the safety stock level discussed in Chapter II. Recall that one MK82 was consumed when the aircraft was loaded. Thus one LCOM MK82 represents one full load. If the simulation is processing 24 aircraft, each flying one sortie per day, the safety stock level of 24 is one day's worth of MK82 munitions. This control logic is queried as a result of either actual sortie consumption or daily frag order scheduled on the exogenous file. Thus, the prime objective of the munitions control in this model is to maintain a pre-determined safety stock level.

Assuming that this buildup check is passed, the model then checks to see if the required NEW capacity is available in any

one of the five buildup areas (lines 532 to 536). This is accomplished by a series of tasks (TBLDA1-5), all on R selection modes. This check requires that a major assumption be made. That is, if a check of required NEW is to be made, one must know the quantity of munitions that is going to be processed. The assumption is that, if the decision is made to build up, it will be for a quantity that can be economically transported from storage. In the MK82 example, this means that the decision to build is also a decision to build 48 MK82's. Forty-eight MK82's will just fill a 25 foot flatbed trailer and is, therefore, an economical buildup lot size. From this assumption, the required NEW at the buildup area can be calculated and entered on the Form 12s as the required quantity on the TBLD tasks mentioned above.

If the required NEW is available, the model then checks the storage area for the proper quantity of munition parts (lines 537 to 541). For the MK82, it checks for tail fins, boosters, fuses and the main body of the bomb. As indicated in Chapter II, each of these components may not be stored in the same quantities. From the LMC data on the MK82, the boosters are packaged in quantities of 200 per container. Thus for every lot of 48 bombs, only .240 lots of boosters are required (48/200=.240). This is simulated by requiring the consumption of boosters only 24 percent of the time that a lot of 48 MK82's is produced. Similar logic is used for the remaining components, as reflected on lines 558, 560 and 562 in the Form 11s.

When this last component check is passed, two events occur. First, parts are delivered to the buildup area and production

begins. Second, at line 547, four MK82 resources are generated. A check is then again made of the safety stock level and, if it is less than 24, production is started for another lot. This re-check feature allows the simultaneous buildup of more than one lot of bombs without having to wait until each lot is actually produced. Of course, any buildup order will be delayed if the NEW and component check cannot be pased. In this model, the components in storage are unlimited because of the emphasis on the buildup function. The component check, however, will allow the model to be easily expanded to include the storage function, which can be modeled to produce specific quantities of these component parts.

Component Delivery Network. (line 574 to 653) The delivery section is contained in the call section referenced by task CDMK82 at line 573. The call section requires all components to be delivered to the buildup area before production can begin. Again, in the interest of brevity, only the delivery of the bomb body will be explained. Similar logic is used for the other components. The first choice in delivering components is to select the combination of tow and trailer vehicles that is available. The LMC data shows that any combination of a 5 ton or 10 ton tractor and a 25 or 40 foot flatbed trailer is acceptable. A series of four R selection mode tasks were set up to model the four possible combination of these resources. (lines 575 to 578) Depending on which is available, the proper set is consumed, to be generated again after delivery is complete. Fork lifts are required at both the storage and holding area. Because these

resources are only required on one of the three tasks in the delivery process, the general substitution feature described earlier was used for the 4, 6 and 10 thousand pound fork lift. A distinction was made between fork lifts in the storage area (4FORKS) vice the holding area (4FORKC), as it is not common practice to shuttle this equipment between the two areas. Again the tasks in this section (MK8201-C1) have a name convention similar to that in the consumption logic. Examination of the Form 12 records for these tasks will make the meaning of the convention clear. When the component is delivered and off-loaded at the buildup area, (MK8204), the proper set of transportation resources is regenerated. Equipment identity is maintained by having independent networks branching from the R mode task. Each of these networks processes the same intermediate tasks but terminates at a unique node that generates the proper resources, depending upon the R-mode path taken. When all components are delivered and resources regenerated, the buildup network can be entered.

Buildup Network. (lines 654 to 678) The buildup network is relatively simple, consisting of two tasks, MK8218 and 19. These tasks have standard resource definitions on the Form 12. Note here the various acceptable combinations of qualified and augmentation manpower resources as listed on the Form 12A. At the end of the buildup tasks, the finished munition generation network is entered (line 656 to 681). Here the question is just the mirror image of that asked during flight line consumption.

That is, first a check is made as to what trailer (MHU11,85 or 12) is available and then which holding area has the required NEW capacity. Depending upon which combination is available, the proper trailer and holding area are consumed and the associated munition resource is generated. Because only 6 bombs can be loaded on a trailer, this generate network is reiterated eight times to match the buildup lot size of 48 MK82s. The completion of this generation marks the end of a buildup cycle and the replenishment of holding area munitions. The number of simultaneous buildup processes that can occur is limited only by the quantity of resources available. The interaction of these resources and the resultant impact on achievable sortie rate will be explored in the next chapter.

Equipment Repair Networks. (line 805 to 842) Each of the equipment resources has an associated repair network, represented by a single task. Entry to that repair task is controlled by individual failure clocks. The clock values are expressed in mean time between failures. A timing mechanism is set up (line 805 to 806) that has a task occurring every half hour throughout the simulation. Each time the task occurs, the equipment clocks are decremented by 1 and a check is made to see if a clock has been decremented to zero. If so, the particular resource is removed from the available pool for the length of the repair time. A variety of failure rates and distributions were used for the clock values to demonstrate the flexibility in the model to capture a variety of maintainability information.

This completes the model description section. The following paragraphs summarize the main assumptions of the model.

Model Assumptions

The major assumption in the this model is that munitions are produced in discrete lots. This assumption is the basis for the munitions accounting that takes place and is key to the quantity normalization that economizes on computer run time. Production of munitions in variable lot sizes would require construction of a different model, necessitating a different method of accounting for munitions quantities.

A second assumption is that there is no returned ordnance, either because of a malfunction during pre-load checks or because of unexpended munitions during the sortie. Although past experience indicates such occurances to be insignificant in terms of resource requirements, they may, under certain scenarios (peacetime, for example), place a demand on munitions resources in addition to those currently modeled. The present network structure, however, can accomodate such scenarios. In essence, these returned munitions would represent another source of production. At the appropriate point in the main flight line network, the repair or return networks could be activated and, if the munitions could be repaired or were still serviceable, the on-hand balance would be increased accordingly. If the munition were condemned, resources would be utilized in disposal activities, but no change would be made in on-hand balances.

Finally, there is an implicit assumption that no sortie is loaded with a partial complement of munitions. For instance,

unless there are two MK82XX resources on hand, a sortie will not be loaded, even though there may be one lot of six bombs in the holding area. This assumption stems from the intended use of the model as a requirements determination tool. The object is to provide sufficient resources to insure that a full complement of munitions is available to meet the sortie demand. Allowing partial loading would lead to an understatement of requirements and is more properly the function of a capability assesment model.

The above discussion of assumptions completes the explanation of the model development. The concluding section will explain the procedures for changing many of the variables and resource quantities that were described above. With this knowledge, the reader will better understand the intent and results of the simulation runs summarized in Chapter IV.

Parameter Changes

One of the main design features of the LCOM is the capability to change various parameter values at any time during the simulation. These changes are accomplished by placing selected change cards in the job control listing (JCL) before executing the actual simulation. The current version of the LCOM has 88 possible change cards from which to choose. (1:7-4) Many of these cards control features of the model other than variable values. The discussion that follows deals primarily with the cards that were used in the test simulations to demonstrate the use of the model as a resource requirements tool.

Resource Quantities. The SAUTH and AUTH change cards are used to establish the authorized quantity of Form 13 resources The SAUTH controls manpower quantities; the AUTH controls all other resources. In constructing the data base, the Form 13 format requires that all resources be assigned an initial authorized quantity. These initial values were made arbitrarily high (999) to simulate unconstrained asset levels. Debug simulations were run with these initial resource levels to check the internal validity of the munitions model. Once that validity was established, iterative simulations were run with decreasing quantity levels, monitoring the achieved sortie rate on each run. The final resource levels were the minimum values to which each resource could be reduced with an acceptable degradation in achieved sortie rate. Recalling the model description in the preceding section, the following categories of resources can be controlled via the SAUTH and AUTH change cards: manpower, transportation vehicles, buildup and storage area NEW capacities, and munitions quantities. Chapter IV contains the calculations used to establish the various change card values as well as a discussion of the simulation results using these changed values.

Reliability and Maintainability Parameters. These parameters consist of the task times and failure clock values contained in the model. The former are changed via a TKCNG change card; the latter via a CKCNG change card. Because many of these values are hypothetical, no conclusive results were to be achieved by running simulations against different values for these parameters. The capability to make such changes, however, has

several potential applications. One such application would be to establish the sensitivity of the sortie rate and resource quantities to variations in munitions processing times. This knowledge could be used to establish the degree of accuracy necessary in any subsequent data collection effort. A second use would be to investigate the impact of certain external factors, such as the chemical or nuclear environment, on resource requirements. Both of these circumstances are likely to change normal processing task times. This change could be simulated via the use of the TKCNG cards.

BUILDUP CONTROL. A central feature in the munitions model is the control mechanism for triggering the start of munitions buildup. Recall that this was accomplished by using the TMK81A task on a R selection mode, which queried the on-hand balance of each munition type, both after loading a sortie and once a day as a function of the planned frag. This query was simulated by specifying the desired inventory level in the required resource column on the trigger tasks as specified in the Form 12s. Unfortunately, there is no provision in the LCOM to change this specified quantity via change cards. An alternate procedure using the task substitution (TSUB) change card overcomes this limitation to some degree. The TSUB card allows the user to substitute any defined task in the Form 12s for the task originally specified between nodes in the Form 11s. To take advantage of this feature, five different tasks, each with a different required resource quantity, were defined in the Form 12s for each munition type. Thus, within the limits of these

five task quantities, the on-hand trigger quantity can be varied by using the TSUB change card. Of course, different values can be set by changing the values specified on the Form 12s, but this would require re-initializing the model. Regardless of how the trigger quantity is changed, investigating the impact of such changes could provide valuable insight into munitions inventory control policies. For example, it would be useful to know to what level the safety stock could be reduced without degrading sortie generation. The lower the stock level, the lower would be the requirements for holding area capacity and munitions trailers. Reduction in the safety stock level, on the other hand, places a premium on munitions production capacity. Thus there would be a tradeoff between storage trailers and holding area capacity versus production manpower and buildup area capacity. Investigations of this type should prove of value to munitions planners.

Another question related to munitions control concerns the feedback of sortie consumption to the buildup control routine. As presently modeled, that feedback occurs at each sortie. Thus, any production order based on the expected flying schedule will probably find the on-hand assets already at safety stock level as a result of sortie feedback initiating munitions production. In fact, it may be more desirable to have production triggered only by the frag order so that production would occur at scheduled times and would produce only the next day's munitions. The on-hand assets would then be drawn down to zero each day, to be replaced by production triggered by the next day's flying

schedule. Another possibility would be to have the sortie feedback mechanism operative only during certain days of the simulation, in response to mass launch requirements or during an initial surge period. The possible control variations are numerous. Simulation of these variations can be implemented using the EPROB change card. In the main flight line networks, the sortie feedback section (lines 469-470) is composed of two tasks in parallel, controlled by an E selection mode. The E selection mode operates such that one, and only one, of the possible paths is processed, based on the mutually exclusive probability values specified for each path. As the path leading to the buildup control routine (line 469) has a value of 1.0, sortie feedback will always occur. The EPROB change card allows the user to change these probability values at any specified time during the simulation. Thus, the user can readily investigate a variety of control schemes. The combination of varying control quantities and degree of sortie feedback will permit investigation of a wide range of control policies.

This concluding section on parameter changes shows the reader the wide range of analytical options, easily implemented, that are available in the munitions model. This control feature, together with the explanation of the network logic and model assumptions contained in the initial sections of the chapter, were designed to provide a working knowledge of the munitions production model. The next chapter will familiarize the reader with the various LCOM output products and explain the validation checks that were made in verifying the munitions model.

IV. Model Verification and Demonstration

Introduction

This chapter is composed of two principal subsections. The first will describe the validation checks made on the munitions model. The format and use of simulation output products will be apparent as various results are compared to insure the internal consistency of the model's logic. These output products are contained in Appendix B and, as in Chapter III, this information will be referenced throughout the following explanation. The second section deals with the use of the model to determine resource requirements. The impact of limited resources on sortie rate will be demonstrated and concluding remarks will discuss the computer utilization and data requirements of the model. Because sortie rate is the global measurement parameter in this model, the first section will begin with a discussion of the scenario used to exercise the model and an explanation of the procedure used to determine achieved sortie rate from the output statistics.

Scenario

For the demonstration purposes of this research, a squadron of 24 aircraft was used to generate demands for munitions. The TFX

aircraft were tasked to fly 1.0 sorties/day and each sortie carried the following munitions: 12 MK82 General Purpose Bombs; 4 AIM9 missiles; and 1500 rounds of 20mm ammunition. All munitions were assumed to be expended on each sortie.

The continuous loop nature of the main flight line network was explained in Chapter III. To determine the length of the SORTIE task so that a 1.0 sortie rate would be achieved, the summation of all flight line tasks was subtracted from the 24 hours available in a day; in essence, the 24 aircraft were either ground processing or flying. The calculations to determine sortie length are shown below. The task times can be found following each task name in the Form 12s in Appendix A.

TASK	TIME (HOURS)
Preflt	1.5
Pstflt	2.5
Refuel	1.0
QM82XX	.3
LDMK82	1.0
Total	6.3 hours

24 hours/day - 6.3 hours = 17.7 hours/sortie

NOTE: The three load tasks (LDMK82, LD20MM and LDAIM9) are done in parallel, and all must be completed before the aircraft can continue processing. Therefore, the longest task (LDMK82) establishes the loading time line and was used in the above calculations.

Thus, to achieve the target sortie rate of 1.0 sorties per day, each aircraft completes a full cycle in 24 hours. Target sortie rate can be changed easily by varying the sortie task length. The equation for computing sortie length is shown below.

$$\text{Sortie Length} = \frac{24 \text{ hours} - \text{Processing time}}{\text{Sortie rate}}$$

For a 1.5 sortie rate: $\text{Sortie Length} = \frac{(24 - 6.3)}{1.5}$

$= 11.8$ hours

Confirming that the achieved sortie rate is indeed equal to the target is not as readily apparent in the output from the demonstration simulations as it would be if a wartime scenario were being modeled because the sorties are input as aircraft processing activities instead of actual missions. If a wartime scenario were modeled, the sortie rate would be calculated internally by the model and displayed as statistic #23 under the Aircraft section of the PSR. For the demonstration simulation in Appendix B, however, statistic #33 under the Personnel section must be used to determine sortie rate. Looking at the task definition on line 139 of the Form 12s in the data base, one PILOT resource is required every time the aircraft processes the SORTIE task. Thus, the number of demands for the PILOT resource can be used to determine the number of sorties flown, and the manhours used statistic (#29) is the number of flying hours accumulated. For the 30 days shown in the PSR in Appendix B, these statistics are used as follows to calculate achieved sortie rate and average sortie length.

Number of PILOT demands = 717

$\frac{717 \text{ sorties}}{30 \text{ days} \times 24 \text{ aircraft}}$ = .996 sorties/aircraft/day

Number of manhours used = 12525

$\frac{12525 \text{ hours}}{717 \text{ sorties}}$ = 17.4 hours/sortie

As shown above, the sortie rate and length are easily calculated. As the main purpose of this research is to study the munitions environment and not a specific scenario, this procedure is a small penalty to pay for the convenience of changing the target sortie rate via the task change cards instead of having to create a new exogneous file. Keeping this sortie rate procedure in mind, the model debug process can now be described.

Validation Simulations

The basic procedure for checking the internal logic or validity of the model is to simulate flight operations with unconstrained resources and compare the outcome with expected results. Before going through this comparison, it is necessary to describe how certain parameter values and initial conditions were established. Detailed explanations will be given for the MK82 networks and calculations. Only the calculations will be shown for the AIM9 and 20MM networks.

Internal Parameters - MK82. Most of the internal parameter values shown below were extracted from the MK82 network data gathered by the LMC. For the reader's reference, this data is contained in Appendix C. The following information was derived both from this data and from the described scenario.

Lot size for buildup (LSB) = 48 bombs. Six bombs are contained on one pallet and 8 pallets will maximize the carrying capacity of a 25 or 40 foot flatbed trailer.

Generation Quantity (GQ) = 6 bombs. Six bombs fill a MHU-12M, MHU-85 or a MHU-110 munitions trailer.

Aircraft Load Quantity (LQ) = 12 bombs. Established by the scenario.

Net Explosive Weight (NEW) = 298 lbs/bomb. (13:4)

To prevent excessive run time, these quantities were normalized to the lowest common denominator as shown below.

	Calculated	LCOM
LSB	48	8
LQ	12	2
GQ	6	1

Using the LCOM column, the database reflects that two M82XX resources are consumed when the QM82XX consumption task is performed and one M82XX resource is generated on the GM82XX task. Also, for each QM82XX task, one MK82 trigger resource, equivalent to 12 bombs, is consumed. When MK82 production begins, four MK82 trigger resources are, in turn, re-generated because one LSB of 48 bombs is equivalent to 4 trigger resources, each of which represents 12 bombs. At the completion of production, a looping mechanism controlled by the halt clock HRMK82 causes the generate task to be repeated 8 times (48 bombs per buildup/6 bombs per generate = 8 iterations).

The calculations for buildup and holding area NEW are more complicated because, unlike each munition unit, the NEW unit must be compatible for all munition types. For this reason, only the actual calculations are shown below; the reduction to LCOM units will be discussed subsequently. For the MK82 buildup and holding area requirements, the calculations are as follows:

Buildup NEW = LSB x NEW/bomb
48 x 298 = 14304 lbs

Holding NEW = GQ x NEW/bomb
6 x 298 = 1788 lbs

This completes the description of the derivation of the MK82 parameter values. The results of similar calculations are shown for the 20MM and AIM9 parameter values.

Internal Parameters - 20MM.

	Calculated	LCOM
LSB	= 42000 rounds	14
LQ	= 1500 rounds	.5
GQ	= 3000 rounds	.1
NEW	= 1/3 lb per round	
Buildup NEW	= 14000 lbs	
Holding NEW	= 1000 lbs	

NOTE: Different network logic was required because one trailer from the holding area can service two aircraft. To model this situation, only every other sortie causes a trailer to be drawn from the holding area. Thus the LQ equals .5 LCOM units.

Internal Parameters - AIM9.

	Calculated	LCOM
LSB	24	6 missiles
LQ	4	1 missile
CQ	4	1
NEW	125 lbs/missile	
Buildup NEW	= 3000 lbs	
Holding NEW	= 500 lbs	

NEW Reductions. Summarizing the calculations for the holding area and buildup area NEW requirements for each munition type:

	Buildup NEW	Holding NEW
MK82	14304	1768

20MM	14000	1000
AIM9	3000	500

Comparing the above data, the lowest figure of 500 was selected as the normalizing factor. It was decided to use the same factor for both holding and buildup as this will simplify interpretation of output statistics. Because LCOM can only generate and consume unit quantities, the LCOM units were rounded to the nearest whole number. This round off introduces a slight error in the NEW requirements that are demanded during the simulation. As area capacity in the real world rarely matches the stored munitions requirements exactly, this error was considered acceptable. The normalized LCOM NEW units are shown below.

	Buildup NEW	Holding NEW
MK82	29	4
20MM	28	2
AIM9	6	1

The parameter values detailed above are basic to the internal logic of the munitions model and are hard wired into the data base. If for any reason the user desires to simulate different conditions, re-initializing the data base will be necessary. The demonstrated calculations should make determining the parameter values relatively straightforward. With an understanding of these internal parameter values, the initial conditions for the debug simulations will be covered next.

Initial Conditions. To obtain meaningful results from the validation simulations, certain initial resource quantities had to

be established. For instance, if the trigger resources were left unconstrained, no production orders would pass the munitions control routine and the buildup networks would not be exercised. Likewise, it is impossible to observe the proper operation of the consumption logic and the buildup re-supply of required munitions if the munitions quantities are left unconstrained. For these reasons, the following values were input via change cards at the beginning of the simulation runs. The demand control tasks, shown last, were selected such that production would attempt to maintain one day's worth of each munition in the holding areas. All other munitions quantities were set to zero. Transportation vehicles and manpower resources were left unconstrained. The constrained resources are as follows:

MK82B1	-	12	20MD1	-	12	AIM9E	-	6
HOLDB	-	951	HOLDD	-	975	HOLDE	-	993
MK82	-	6	20MM	-	12	AIM9	-	6
TMK81A	-	24	T20M5A	-	12	TAIM91	-	24

The simulations were run for thirty days with these initial conditions. At the 30 day point, all inputs to production were stopped and simulation was continued for ten more days. Sortie feedback was prevented from triggering munitions production through the use of the EPROB change card as discussed in Chapter III. The orders based on the daily flying schedule were stopped by removing any ORDER activities beyond day 30. By allowing sortie demands to continue beyond munitions production, information was generated which shows the model operation as available munitions are depleted. The next section discusses the expected results of the validation simulations and describes how these expectations were confirmed by the output statistics.

Output Analysis

With unconstrained manpower, transportation, and area resources, the sortie rate and average length should be equal to the target values input via the SORTIE task. Inadequate munitions production would cause aircraft delays at the munitions consumption task, consequently degrading the sortie rate. The sortie rate calculations in the preceding Scenario section used data from the validation simulation results. These calculations confirm that the expected sortie rate is being achieved and that munitions production is adequate. The estimates for initial munitions quantities were not sufficient to supply sortie requests until production could start re-supplying the holding areas, as evidenced by the "PCT Demand Not Satisfied" statistic (#61) under the Supply heading in the PSR. Observe that this is .01% and that all unsatisfied demands occurred for initial munitions. The delays for these munitions were not sufficient to cause any appreciable degradation in achieved sortie rate, as evidenced by the .996 sortie rate calculated previously. In conjunction, these two statistics (33 and 61) confirm that the sortie rate mechanism is functioning properly and that munitions production is adequate to support this sortie rate.

Contrast these results with those for days 30 through 35 when munitions productiuon was stopped. For this period, only 53 sorties were flown. Statistic 61 shows that 33% of the MK82 demands, 13% of the 20MD1 demands and 27% of the AIM9E demands were unsatisfied. Thus, inadequate munitions production does, in fact, cause a degradation in sortie rate.

Munitions Consume/Generate Analysis. With confirmation that munitions production is adequate, the next check is to insure that an excessive quantity is not being produced. For this check, an additional report, Resource Data, provides more concise output statistics than the PSR. In this report, the simulation resources are referenced by a coded number. The dictionary that maps resource number to resource name is contained at the back of Appendix B. These same resource numbers are also referenced in the AUTH and SAUTH change cards used to input the initial conditions. Returning to munitions production, the buildup trigger resources provide the best analytical tool to analyze production. Recall from the model description that, when the decision to buildup is made, an equivalent number of trigger resources are generated. Thus, if excessive production is not occurring, the maximum on-hand balance of these trigger resources should be equal to the number produced per buildup cycle plus the safety stock level minus one. This condition should prevail throughout the simulation. The expected maximum on-hand balance for each munition is calculated below. The reference number is shown in parentheses.

MK82 (24)		20MM (36)		AIM9 (44)	
TMK82A -	24	T20M1A -	24	TAIM91 -	24
HMK82 -	4	HG20MM -	14	HGAIM9 -	6
	-1		-1		-1
	27		37		29

Resource Data reports were generated at day 15 and 30. The on-hand balances are circled in Appendix B and all are equal to or less than the expected values shown above. The zero on-hand

balances in the 40 day Resource Data report confirms the effect of sortie consumption on munitions quantities and consequently on sortie rate.

Holding Area Analysis. If the consume and generate routines for the holding area resources are correct, the on-hand balance plus any NEW allocated to munitions in the holding area should be equal to the initial quantity of 999 set for each holding area resource. For the MK82 munition, the Resource Data report provides the following data. For day 15, there were 18 M82A1 assets on hand, each requiring 4 NEW units, for a total of 72 NEW units occupied. There are 927 units of HOLDA on hand. Thus the 927 unoccupied NEW plus the 72 occupied equal the predicted quantity of 999. For the 20MD1 resource, the data shows 991 units of HOLDD and 8 units (4 on-hand 20MD1 assets x 2 NEW/ASSET) which again sums to the expected 999 figure. The same check was performed for the remaining holding areas and each confirmed that the consume/generate logic was functioning properly.

Buildup Area Analysis. The 15 and 30 day Resource Data reports are of little value in confirming the correct operation of the buildup routines because it is difficult to determine how many production lines are still in operation and thus consuming buildup area NEW. The 40 day report does not have this limitation. Because all production was stopped on day 30, the on-hand balances should all equal the authorized quantity of 999. The statistics circled in the 40 day report indeed confirm an on-hand balance of 999 for all buildup areas. Thus, with this

simple check, the buildup consumption/generate logic is seen to be operating properly.

To summarize, validation checks have been successfully met on the sortie rate logic, all munitions consume/generate logic and the holding and buildup area usage. The production control operates as designed and it is possible to shut production down if desired. These validation simulations were run under certain limiting conditions to facilitate the checkout tests. The next section will relax these constraints and investigate the model operation with all resources constrained. The results of these subsequent runs can be analyzed with the confidence that the model's internal validity has been confirmed.

Constrained Simulations

The process of constraining resources to arrive at a final set of quantities that are the minimum required to support the target sortie rate is an iterative process. It involves selecting an initial estimate, observing the resultant sortie rate, determining choke points and/or under-constrained resources, changing these resource levels accordingly and running the simulation again. Because many of the parameter values in the data base are hypothetical, the iterations were not conducted until the minimum resource quantities were reached. The purpose of the following explanation is to show how the various output statistics are used in this constraining process and the impact of the different sets of resource quantities on the munitions system. The statistics used in the following explanations are

underlined in the particular PSRs in Appendix B. The AUTH and SAUTH cards used to modify the quantity levels precede each simulation PSR. The resource numbers on these cards can be translated using the dictionaries contained in the back of Appendix B.

Initial Constraints.

Manpower -- The Matrix Post Processor gives a detailed picture of the utilization of manpower throughout the simulation period. The labels on the statistics printed below the matrix display are self-explanatory. The matrix itself depicts the working day in three, eight-hour shifts and, by half hour increments, shows the number of times specific quantities of each resource were utilized. Initial constraints on manpower are internally determined by the model, based on a user selected utilization rate. That utilization rate is based on the percentage of direct labor for a particular AFSC that is represented in the data base. For instance, if the task times do not include travel time to the job site, or do not include time for assembling tools and necessary technical data, then the manhours expended during the simulation would be less than actual work hours. The percentage was arbitrarily chosen in this demonstration as 75%. Thus, the object is to constrain manpower so as not to exceed the 75% utilization factor and, at the same time, to be sufficient to support the desired sortie rate. Example matrix outputs are included for the 461CQ and 461CS manpower resources. The internal conversions of manhours to

manpower spaces are circled on these printouts. These figures were input via the SAUTH change cards. The same procedure was used for all manpower resources except the 431F1, 462X2 and PILOT. These resources were left unconstrained so that the impact of munitions production manpower could be observed more clearly.

<u>Parts and Equipment</u> -- The initial constraints for parts and equipment were based on the average daily usage. As an initial constraint, this quantity used per day is excessive, but provides the first cut information with which to make a more refined calculation. The procedure will be illustrated using the holding area resources. The calculations are similar for the remaining parts and equipment.

Looking at the 30 day debug simulation data, statistic #57 gives the total demand for each of the holding areas. Observe that only holding areas A, D and E had any demands. This occurred because the quantities were unrestricted and munitions were always able to be stored in the first area searched. Dividing each demand by 30 gives the average daily demand as follows:

$$\text{HOLDA} - \frac{5772}{30} = 192.4$$

$$\text{HOLDD} - \frac{728}{30} = 24.27$$

$$\text{HOLDE} - \frac{727}{30} = 24.23$$

Distributing these quantities across all the possible holding areas for each munition, accounting for the NEW requirements per generation, gives the initial holding area constraints.

	HOLDA	HOLDB	HOLDC	HOLDD	HOLDE
MK82	36	36	36	36	36
20MM	--	12	--	12	--
AIM9	--	--	12	--	12
Total	36	48	48	48	48

The remaining initial constraints are shown in the change card files preceding the first constrained simulation results.

First Constrained Run. For this first simulation, statistic #33 under the Personnel heading shows a demand for 712 pilots for 30 days which, using the procedures described earlier, equals a sortie rate of .989. One or more resources are causing a bottleneck, as evidenced by the degradation in sortie rate from the .996 achieved with unconstrained resources.

Manpower -- Looking first at the demands unsatisfied statistic (#38), the 461SQ and 461SS resources show a significant number of demands which could not be satisfied, 15.93% and 17.91%, respectively. The back-order manpower matrix for each resource gives a display of the number of requirements in excess of on-hand balance. This information indicates that a majority of these back-orders could be eliminated if 2 additional 461SQs were added per shift and 2 additional 461SS spaces were added on the first and third shift and 4 on the second shift. These new quantities are reflected in the change card file for the next simulation run.

Parts and Equipment -- Looking next at the parts information, statistic #61 shows that the MK82A1, the BLDA1, the 20MD1 and the BLDB1 resources account for all of the unsatisfied

demands. Since both the BLD resources are the first buildup areas searched when initiating production for these munitions types, it appears that the initial constraints on these buildup areas were excessive. Because all the MK82 buildup areas show some demands, it can be deduced that as many as five production lines were in use at one time during the simulation. This is evidently not sufficient, so BLDA1 and A2 were increased to allow the simultaneous buildup of two LSBs of MK82 resources in these areas. The increase of these quantities from 35 to 58 can be seen in the CNGFILE2 printout preceding the second simulation results in Appendix B. As the lack of buildup area for the 20MM munition caused only 4 unsatisfied demands in 712 sorties, the BLDB1 resource was not changed. This situation is an optimum constrained condition; i.e., there are some unsatisfied demands, but not of a sufficient quantity or duration to degrade sortie rate excessively.

The changes just discussed should open the slight bottlenecks that presently are reducing sortie rate. The remaining resources, however, have not been sufficiently constrained. For example, the holding areas show demands only for the first two areas searched for the MK82 and only for the first area searched for the 20MM and AIM9 munitions. If these holding areas had been more tightly constrained, all of the holding areas should have been utilized, and possibly back-ordered to some degree. The same under-constrained condition exists for the equipment, as evidenced by the very low total number of back-order days (#74) and the correspondingly high PCT UNUSED statistic (#73).

To further constrain the parts and equipment, the information under the CUTIL. FACTOR heading of the Resource Report will be used. In essence, this factor is an expression of the amount of time that parts were available on the shelf. For example, part #66 (3/4TON) had an authorized quantity of 13 and no demands in 30 days. It therefore accumulated 390 days of shelf life, (30 x 13 = 390). The difference between the reported and maximum possible shelf life is a measure of the idle time of a particular part. By treating this residual shelf life as a constant, and by having it represent a target percentage of the maximum shelf life available, an equation can be derived with which to calculate a new resource quantity. That derivation is shown below.

Equation: $$\frac{(30\ \text{days})X - (\text{Max Cutil} - \text{Avail Cutil})}{(30\ \text{days})X} = \%$$

Where: X = Resource Quantity

Or: $$X = \frac{(\text{Max Cutil} - \text{Avail Cutil})}{30(1 - \%)}$$

Assumming: Desired % = .50

Then: $$X = \frac{(\text{Max Cutil} - \text{Avail Cutil})}{15}$$

Application: For the MB4, 5TON and 10TON resources, which are interchangeable, the Resource Report shows the following data.

	Auth #	MAX Cutil	Cutil
MB4	17	510	479.3
5TON	38	1140	1101.4
10TON	38	1140	1095.4
Total		2790	2676.1

Thus: $$\frac{(2790 - 2676.1)}{15} = 7.59 \quad \text{or 7 units}$$

Note: This percentage is arbitrarily chosen and can be adjusted as more information is gained from subsequent simulations

These seven units were distributed as evenly as possible among the three types of equipment, as seen in the change card file. The quantities for the buildup and holding areas were derived using the above formula but were adjusted to match the multiple unit demands (see page 59) for each munitions type so as to most efficiently use these area resources. The results for the simulation run with these new resource levels are discussed in the next section.

Second Constrained Run. The 707 PILOT demands during this run indicate a .982 achieved sortie rate. The decrease from the previous run again indicates that one or more bottlenecks have been created by the new constraints placed on the resource quantities.

Manpower -- The additional manpower added to the 461SQ and the 461SS resources significantly reduced the percentage of demands not satisfied, eliminating it entirely for the 461SQ. The price paid, however, was a large decrease in the percent of utilization for these two resources. Recall that optimum utilization would be 75% with an acceptable sortie rate. If further simulations were run, some of the added manpower should be taken back out, possibly leaving the increases in the most heavily worked shift, as indicated in the MATRIX displays. This iterative process is characteristic of the constraining procedure.

Parts and Equipment -- The increase in buildup area resources reduced the back-order observed in the previous run, and, because all five BLDA areas are in use, simultaneous produc-

tion is still occurring. The increase in the percentage of demands not satisfied for the MK82A1, however, indicates that the bottleneck in production has shifted to another resource. There is one caution in relating this percentage to the number of demands. Because the holding areas quantities were reduced, the MK82 assets are now being stored in all areas except HOLDE. However, because of the nature of the R selection mode, back-orders for any of the MK82 will be counted against the MK82A1 resource because it was the first one searched in the list of R tasks. This back-order accounting will apply for all resources on tasks having an R selection mode. Observe also that the 20MM and AIM9 are still only being stored in the first holding area searched. Specific reduction in the HOLDD and HOLDE resources may force this distribution, if so desired. Caution should be exercised, however, as the MK82 is also competing for these holding area resources. Various simulations would have to be run to see if it is more economical to dedicate particular holding areas to specific munitions or to consolidate all holding areas into one pool.

Looking at the equipment resources, the constraining formula evenly distributed the back-orders; that is, there is no one particular piece of equipment with high back-order days that would indicate a bottleneck. The next step would be to assume a lower unused shelf life percentage and re-calculate the quantities. As may be expected, the closer the resource quantities get to the minimum figure desired, the more difficult it becomes to single out the choke points. This even

distribution of back-order days is a good indication of proper constraining techniques, and the slight reduction in sortie rate indicates that the resource quantities are close to an acceptable set of requirements. This set, however, is only one of the many that may support the desired sortie rate. The tradeoff between various resources is governed by external policy decisions and, as such, is not within the scope of this research.

Summary. From the two iterations discussed above, it can be seen that each step further refines the resource quantities toward the desired minimum level. Further iterations were not presented because no additional information regarding the techniques for constraining resources would have been gained. The bias of the LCOM as a manpower tool is evident in the MATRIX display, with the wealth of information it gives on manpower utilization in the model. The Version 4.0 LCOM release will have revised Eq ·pment and Parts Post Processors that should provide more information concerning parts and equipment utilization. Several other possibilities for enhancing other aspects of the LCOM are (ntained in the final chapter of this report.

COMPUTER UTILIZATION

In addition to the simulation results discussed above, the computer resources required to exercise the model will have a bearing when comparing this LCOM model to other competing designs. For that reason, the computer utilization observed during the simulation runs are presented below.

The core requirements and central processing time are important factors to consider in comparing simulation models.

A model that captures the pertinent features of a system, but which requires excessive computer support, loses its utility for operational use. To aid in comparing this LCOM model to competing designs, the computer requirements observed during the simulations conducted on the Honeywell 6000 computer are tabulated below.

	Storage Space (LLinks)	Core	Run Time (CPU Hours)
Input module	162	40K	.008
Main Module	245	43K	.38
Decoder Module	41	18K	.087
Matrix Post Processor	82	35K	.101
Exogenous File	6	NA	NA
Data Base	44	NA	NA

These figures, particularly the core and run time requirements, are dependent upon the specific conditions of the validation simulations. The length of the simulation (30 days) is important to consider because any increase will cause all the above figures to increase except the data base requirements. The data base requirements are, of course, dependent upon the number of munitions modeled. Keeping these qualifying conditions in mind, the above figures should give a basis for comparison with other models.

A second consideration in evaluating simulation models is the different types of computers that can process the model. This number is dependent upon the existence of a suitable compiler for the language in which a particular model is written.

Creating new compilers is usually an expensive and time consuming process. Thus, the more compilers that exist for a particular language, the more useful will be the model. The LCOM is written in the Simscript II language. Compilers exist for this language on the Honeywell 6000, the CDC and IBM computer systems in use in the Air Force.

The considerations outlined above offer several elements for comparison that, although of lesser importance than the actual simulation results, must still be considered in a complete evaluation of any munitions model. The concluding section discusses several features of the data elements used in the model that are of interest in future data collection efforts.

Data Requirements

The critical nature of buildup task times was illustrated during the first simulation by the MK82 production time line and its impact on production rate. Data on the manpower crew sizes and buildup equipment must be carefully gathered as it can have a significant impact on resource requirements. Regarding crew sizes, only the minimum number of personnel required to accomplish a task should be entered on each task segment. While it may be customary to work a production line with a crew of ten, if the task in the network can be started with less than the desired team, the lower number should be used as the crew size. Parallel task networking will allow the model to determine if the time line can be extended without degrading achieved sortie rate. Inflated crew sizes produce low manpower utilization factors and corresponding excess manpower requirements.

Although equipment failure and repair were included in the model, the arbitrary failure rates were not great enough to cause much effect. If failure rates are expressed in mean time between failures, these figures must be adjusted for the increased utilization that occurs in accelerated wartime munitions production. If possible, failure rates would be best expressed in terms that directly relate to utilization, such as mean failures per bomb loaded or per delivery. This would eliminate the need to adjust peacetime utilization rates by estimated wartime factors.

In conclusion, the above discussion of simulation results were designed to acquaint the reader with the output statistics available through LCOM and how this information can be used in conjunction with the parameter control features to analyze support resource capabilities and thus determine resource requirements. These results, together with the computer utilization figures and data requirements, will be used in the next chapter to evaluate the suitability of LCOM model in simulating the munitions production process.

V. Conclusions and Recommendations

Introduction

The preceding chapters have explained the logic of the munitions model and demonstrated its use in determining support resource requirements. This use is but one of the many ways that the model could be used to assist munitions planners. Other uses have been suggested in this text and more will arise if the model is exercised in the field. The simulations run using the model have been sufficient to generate the data with which to evaluate the suitability of LCOM but, due to time constraints, do not represent an exhaustive validation of the model. As Emshoff and Sisson have described, the construction of a simulation model is an iterative process, as shown in Figure 4. (14:50) As it exists at the completion of this research, the model is in one of the early iterations of this process. Further validation simulations will reveal more information about the inter-relationships captured by the model and should lead to further modification and improvements. Interface with munitions planners should also generate additional improvements to tailor the model to their needs. The first step in providing the needed analytical tool, however, is the selection of a single methodology so that further development efforts can be effectively concentrated.

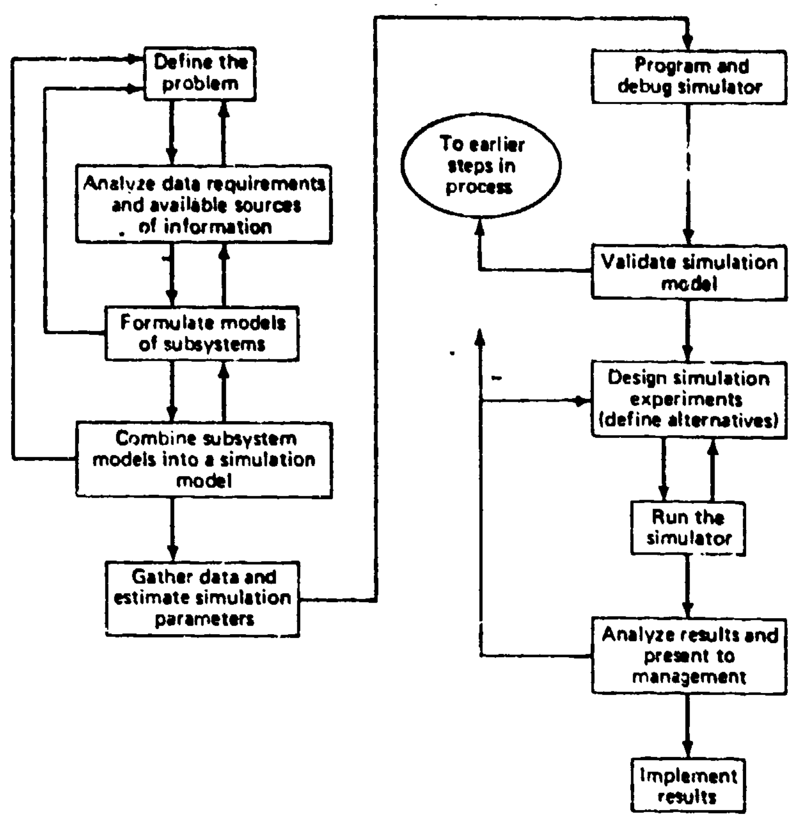

Figure 4. Iterative Process of Model Construction (15:50)

To aid in that selection, this concluding chapter offers an evaluation of the munitions model based on the criteria established in Chapter I. This evaluation cannot support the recommendation of LCOM as the single methodology to be used because not other alternative designs were evaluated. It will, however, point out the strengths and weaknesses of the LCOM approach, and this information should be of value in any future comparison with competing models.

Model Evaluation

The following discussion will evaluate the model against the eight criteria in the same order that they were listed in Chapter I. The reader is urged to review these criteria as they will be referenced below only by number.

Criterion 1: As the LCOM was designed to model resource utilization, the munitions model, overall, satisfies this criterion very well. From the model description, each task segment can have associated with it a virtually unlimited number of resources. The software logic automatically handles task resource demands, drawing and releasing resources from a common pool for each resource type according to task length. Backorders demands and the rescheduling of delayed tasks are also handled automatically. A full range of statistics describing resource utilization are available on demand. Using the change card procedure, the user can easily vary resource quantities throughout the simulation, and the failure and repair logic accurately simulates resource limitations based on utilization during the simulation. However, the method of relating a munition type to a holding area and/or transportation vehicle is cumbersome, as it necessitaties splitting one resource into several distinct entities. The method contained in the model handles the problem adequately but does so at the expense of main model core usage. With this exception, however, the model satisfactorily simulates resource utilization and interaction.

Criterion 2: One of the strongest assests of the LCOM is its excellent fulfillment of this criterion. As seen from the

analysis of simulation results, the output produces a direct measure of sortie generation and all analyses of resource capability, munitions management policy and data sensitivity can be directly measured through the sortie rate statistic. Sortie rate can, however, be misleading because resource requirements are more often determined by sortie timing than by the aggregate number of sorties scheduled. Although not utilized in this research in the interest of generality, as already discussed, there are well established procedures for incorporating any given flying scenario into the exogenous file that drives resource utilization during the simulation. Regardless of how these exogenous events are scheduled, the LCOM relates all resource capabilities to sortie generation and thus provides quantified and fully supported resource requirements.

Criterion 3: The model used three different munitions types, and simultaneous production occured throughout the simulation. The only limitation in the capability of LCOM to satisfy this criterion is in computer core limitations. A portion of that limitation is driven by the munitions splitting scheme discussed under the first criterion.

Criterion 4: The three categories of munitions were specifically designed to illustrate the flexibility of the LCOM to simulate a variety of production processes. Given the flexibility and adaptability demonstrated in this model, the only limitation in simulating a unique production process is the analyst's imagination and knowledge of LCOM.

Criterion 5: Given the 88 change card options in LCOM, the user has a wide range of easily changed parameters and variables with which to explore munitions production. The use of these change cards was illustrated during the constraining process and several other suggestions for their use were offered in Chapter III under the "Parameter Changes" section. Other than the basic network logic, the only parameters which cannot be readily changed are the individual task resources. Even these parameters can be changed by re-initializing the data base, which is relatively simple given a basic working knowledge of LCOM. In aggregate, the ability to easily change model parameters is the second strongest asset of the LCOM.

Criterion 6: The expansion to include these areas has already been incorporated in the model. In fact, the consumption of munitions during aircraft loading is the key to relating munitions production, and thus munitions support resources, to sortie generation. The model thus contains the skeletal framework for simulating the complete munitions production system. Only the buildup section was fleshed out in this model due to the scope of the research effort.

Criterion 7: Air Force Management Engineering regulations and procedures are well established for gathering task time and resource requirements for most all functional areas within the Air Force. Expanding the coverage to munitions production poses no problem except that it is difficult to find operational situations to observe where live ordnance production occurs in the magnitude likely during a wartime scenario. Various Air

Force exercises such as Red Flag could provide fruitfull areas for such data collection. Equipment failure rates is another matter. The method presented in this model is unsatisfactory as it represents failures as a function of calendar time. Thus, regardless of utilization within the model, the equipment always fails at the same rate. Efforts should be expended to gather failure data based on equipment utilization similar to the mean sorties per failure commonly used for aircraft equipment. Improvement is required in this data area, but the LCOM failure routines are flexible enough to utilize data gathered from the field in most any format, as long as it relates failure rates to equipment utilization.

Criterion 8: As a methodology widely used in the Air Force manpower community and research, test and development agencies, the LCOM is highly compatible with most computer systems currently used in the Air Force. Secondary suport programs are continually being developed by the various users and disseminated via the LCOM infrastructure discussed earlier. This compatibility of LCOM to Air Force systems and the organizational support structure that exists behind LCOM is its third strongest asset supporting its recommendation as a munitions modeling methodology.

Conclusions

The model developed in this research demonstrates how the LCOM can capture the complex interrelationships of munitions support resources and, most importantly, how each of these resources contributes to sortie generation. The model was

designed so that the user can easily change most of the important parameters and can explore the impact of various control policies on resource requirements and sortie generation capability. In fact the model's three strongest features are its ability to directly relate resource capability to sortie generation, the ease with which key parameters can be changed and the existing infrastructure that supports LCOM in general. In short, the LCOM has a great deal of potential as a munitions simulation tool.

The project that generated this research effort will hopefully be the first step in providing munitions planners with a much needed tool to use in a systems analysis of munitions production. An adequate munitions supply is crucial to the combat readiness of the Air Force, and adequate logistics support is a key factor in insuring that supply. To aid future efforts in the search for this tool, the following recommendations are offered, first in the area of further exploration of the munitions model developed in the study and second in suggested enhancements to the LCOM software.

Recommendations

Suggested efforts in exercising the model further should include: longer simulation periods to disclose any inconsistent long run trends; variations in the demand control parameters to more fully explore the logic of this routine; and continuing development of the resource constraining procedure. An invaluable aid in this validation effort would be the inputs and suggestions of munitions planners. They are most familiar with

the system modeled and should prove a knowledgeable source of "what if" ideas to test the functioning of the model.

The second suggestion would be to exercise the model using a typical scenario, so that actual missions are scheduled in the exogenous file instead of activities. A relatively simple way to accomplish this would be to use the networks and exogenous file already developed by one of the using LCOM agencies. The information this generates concerning computer utilization would give a better appreciation for these requirements if the model is placed in the field. Another approach would be to explore using the realized flying schedule from an LCOM aircraft maintenance manpower model to provide the exogenous events which trigger munitions production. This latter method may prove valuable in tying both the munitions production and aircraft maintenance systems together without having to pay too high a price in either core or run time.

Third, efforts should be directed toward collecting data on task times, equipment reliability and repair. This data development must be done regardless of which simulation model is ultimately chosen. The MK82 network in Appendix C provides a good starting structure for gathering this data. The simulation model offered by this research could be used to determine the sensitivity of the parameters in this data and thus focus data gathering efforts on the key elements.

Finally, the enhanced versions of the Parts and Support Equipment Post Processors should be run when they are released by AFMSMET. These output products should provide additional insight

into resource utilization and assist in the constraining process. The LCOM version 4.0 is scheduled for release by AFMSMET sometime in the summer of 1981.

Suggested LCOM Enhancements

In working with this munitions model and anlayzing the simulation results, two improvements to the LCOM surfaced that would improve its use in studying the munitions production process and other analogous systems. The first concerns the generation routine in the LCOM. As it now stands, only one part can be added to the available pool each time a generate task is performed. In contrast, the consume routine allows the user to specify up to 99 resources to be consumed per task. The same capability on the generate tasks would alleviate the rather cumbersome technique of loop networking controlled halt clocks. In addition, the comparatively large quantities of resources dealt with in the munitions world suggest that the quantity field be increased to at least three digits. This enhancement would prove most valuable in modeling a variable buildup lot size, where individual round accounting may be necessary.

The second suggestion concerns the Graph Post Processor. This useful routine is seldom exercised because it can display only the statistics listed under the TOTAL column in the PSRs. This gives little information concerning individual resource utilization. If modified to display the same statistics but on an individual item basis, the Graph Post Processor could prove

as powerful a tool as the Matrix Post Processor. In the munitions model, for example, it would have been interesting to compare the time sequenced graphs for the demands and generations of a particular munition. Just the graph of the demands alone would provide valuable information on the maximum and minimum utilization for the resource, which would improve and perhaps shorten the constraining process.

These suggestions and recommendations offer areas for further exploration that the researcher feels would be of the most value in continuing the developemnt of the munitions model and in improving the capability of the LCOM software. As it now stands, the model adequately demonstrates how the LCOM can successfully simulate and be used to analyze the munitions production environment. Continuing effort is required, however, to produce a model that is suitable for use in the operational world of the Air Force munitions planner.

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Appendix A

MUNITIONS MODEL DATABASE

DATABASE
****

AS OF:
04/03/81

```
1 10
2 1001     1D     7
3 1004 CAS    TIMER ORDER
4 1005 TFX
5 1007 431F1 462X0 PILOT 461SQ 461SS 461CQ 461CS
6 1009 OTHER M82A1 M82B1 M82C1 M82D1 M82E1 M82A2 M82B2 M82C2 M82D2
7 1009 M82E2 M82A3 M82B3 M82C3 M82D3 M82E3 MK82  BLDA1 BLDA2 BLDA3
8 1009 BLDA4 BLDA5 PMK82 82FIN 82BST 82FUS 20MD1 20MB1 20MM  BLDB1
9 1009 BLDB2 BLDB3 BLDB4 P20MM AIM9C AIM9E AIM9  BLDC1 PAIM9 HOLDA
10 1009 HOLDB HOLDC HOLDD HOLDE
11 1011 MB4   5TON  10TON 25FLB 40FLB 4FORKS6FORKS10FORSH-11  JAMER
12 1011 4FORKC6FORKC10FORC1HTON 2HTON MHU12 MHU85 MHU11 CLOCK TIMER
13 1011 3/4TON
14 13
15 13 TFX     I 01    15K
16 13 431F1   M 01    10K   999
17 13 462X0   M 02    10K   999
18 13 PILOT   M 03    10K   999
19 13 461SQ   M 04    10K   999
20 13 461SS   M 05    10K   999 461SQ
21 13 461CQ   M 06    10K   999
22 13 461CS   M 07    10K   999 461CQ
23 13 M82A1   P 02    20K   999
24 13 M82B1   P 03    20K   999
25 13 M82C1   P 04    20K   999
26 13 M82D1   P 05    20K   999
27 13 M82E1   P 06    20K   999
28 13 M82A2   P 07    20K   999
29 13 M82B2   P 08    20K   999
30 13 M82C2   P 09    20K   999
31 13 M82D2   P 10    20K   999
32 13 M82E2   P 11    20K   999
33 13 M82A3   P 12    20K   999
34 13 M82B3   P 13    20K   999
35 13 M82C3   P 14    20K   999
36 13 M82D3   P 15    20K   999
37 13 M82E3   P 16    20K   999
38 13 MK82    P 17    20K   999
39 13 BLDA1   P 18    19K   999
40 13 BLDA2   P 19    20K   999
41 13 BLDA3   P 20    20K   999
42 13 BLDA4   P 21    20K   999
43 13 BLDA5   P 22    20K   999
44 13 PMK82   P 23    20K   999
45 13 82FIN   P 24    20K   999
46 13 82BST   P 25    20K   999
47 13 82FUS   P 26    20K   999
48 13 20MD1   P 27    20K   999
49 13 20MB1   P 28    20K   999
50 13 20MM    P 29    20K   999
51 13 BLDB1   P 30    20K   999
52 13 BLDB2   P 31    20K   999
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53	13	BLDB3	P	32	20K	999					
54	13	BLDB4	P	33	20K	999					
55	13	P20MM	P	34	20K	999					
56	13	AIM9C	P	35	20K	999					
57	13	AIM9E	P	36	20K	999					
58	13	AIM9	P	37	20K	999					
59	13	BLDC1	P	38	20K	999					
60	13	PAIM9	P	39	20K	999					
61	13	HOLDA	P	40	20K	999					
62	13	HOLDB	P	41	20K	999					
63	13	HOLDC	P	42	20K	999					
64	13	HOLDD	P	43	20K	999					
65	13	HOLDE	P	44	20K	999					
66	13	MB4	A	01	20K	999	5TON			10TON	
67	13	5TON	A	02	20K	999					
68	13	10TON	A	03	20K	999					
69	13	25FLB	A	04	20K	999					
70	13	40FLB	A	05	20K	999					
71	13	4FORKS	A	06	20K	999	6FORKS			10FORS	
72	13	6FORKS	A	07	20K	999	4FORKS			10FORS	
73	13	10FORS	A	08	20K	999	4FORKS			6FORKS	
74	13	H-11	A	09	20K	999	4FORKC			6FORKC	10FORC
75	13	JAMER	A	10	20K	999					
76	13	4FORKC	A	11	20K	999	6FORKC			10FORC	
77	13	6FORKC	A	12	20K	999	4FORKC			10FORC	
78	13	10FORC	A	13	20K	999	4FORKC			6FORKC	
79	13	1HTON	A	14	20K	999	3/4TON				
80	13	2HTON	A	15	20K	999					
81	13	MHU12	A	16	29K	999					
82	13	MHU85	A	17	20K	999					
83	13	MHU11	A	18	20K	999					
84	13	CLOCK	*A	19	20K	999					
85	13	FRAG	*A	20	20K	999					
86	13	3/4TON	A	21	20K	999					
87	13	HOLDA	C					8	C		
88	13	HOLDB	C					8	C		
89	13	HOLDC	C					8	C		
90	13	HOLDD	C					8	C		
91	13	HOLDE	C					8	C		
92	13	HMHU12	C					2	C		
93	13	HMHU85	C					2	C		
94	13	HMHU11	C					2	C		
95	13	HMK82	C					4	C		
96	13	HBLDA1	C					29	C		
97	13	HBLDA2	C					29	C		
98	13	HBLDA3	C					29	C		
99	13	HBLDA4	C					29	C		
100	13	HBLDA5	C					29	C		
101	13	HRMK82	C					8	C		
102	13	HLD2D	C					2	C		
103	13	HLD2B	C					2	C		
104	13	HBLDB1	C					28	C		

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105 13 HBLDB2 C                                   28        C
106 13 HBLDB3 C                                   28        C
107 13 HBLDB4 C                                   28        C
108 13 HBL2A1 C                                   28        C
109 13 HG20MM C                                   14        C
110 13 HR20MM C                                   14        C
111 13 HLD2C  C                                    1        C
112 13 HLD2E  C                                    1        C
113 13 HBLDC1 C                                    6        C
114 13 HBL2A5 C                                    6        C
115 13 HGAIM9 C                                    6        C
116 13 HRAIM9 C                                    6        C
117 13 FMB4   C                                  50H      5HN
118 13 F5TON  C                                 100H     10HN
119 13 F10TON C                                  75H      8HN
120 13 F25FLB C                                 500H        C
121 13 F4FORS C                                 250H        C
122 13 F40FLB C                                 500H        C
123 13 F6FORS C                                 250H        X
124 13 F10FRS C                                 250H     25HN
125 13 FH-11  C                                  50H      5HN
126 13 FJAMR  C                                  60H      6HN
127 13 F4FORC C                                 100H     10HN
128 13 F6FORC C                                 100H     10HN
129 13 F10FRC C                                 100H     10HN
130 13 F1HTON C                                  50H      5HN
131 13 F2HTON C                                 100H     10HN
132 13 FMHU12 C                                 150H     15HN
133 13 FMHU85 C                                 150H     15HN
134 13 FMHU11 C                                 150H     15HN
135 12
136 12 PREFLT 21    1.5H    .2HL              431F1     1
137 12 R      21
138 12 LDMK82 21    1.0H    .1HL              462X0     4
139 12 SORTIE 21   17.7H       C              PILOT     1
140 12 PSTFLT 21    2.5H    .3HL              431F1     2
141 12 REFUEL 21    1.0H    .1HL              431F1     2
142 12 QM82A1 21     .3H    .1HL              M82A1 C 2MK82   C 1461CQ    1
143 12 QM82A1C                                461CS   1MB4    X 1
144 12AQM82A1                          RCS-1 1461CQ   2
145 12 QM82B1 21     .3H    .1HL              M82B1 C 2MK82   C 1461CQ    1
146 12 QM82B1C                                461CS   1MB4    X 1
147 12AQM82B1                          RCS-1 1
148 12 QM82C1 21     .3H    .1HL              M82C1 C 2MK82   C 1461CQ    1
149 12 QM82C1C                                461CS   1MB4    X 1
150 12AQM82C1                          RCS-1 1
151 12 QM82D1 21     .3H    .1HL              M82D1 C 2MK82   C 1461CQ    1
152 12 QM82D1C                                461CS   1MB4    X 1
153 12AQM82D1                          RCS-1 1
154 12 QM82E1 21     .3H    .1HL              M82E1 C 2MK82   C 1461CQ    1
155 12 QM82E1C                                461CS   1MB4    X 1
156 12AQM82E1                          RCS-1 1
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157 12 QM82A2 21    .3H   .1HL           M82A2 C 2MK82  C 1461CQ   1
158 12 QM82A2C                           461CS   1MB4   X 1
159 12AQM82A2                     RCS-1 1
160 12 QM82B2 21    .3H   .1HL           M82B2 C 2MK82  C 1461CQ   1
161 12 QM82B2C                           461CS   1MB4   X 1
162 12AQM82B2                     RCS-1 1
163 12 QM82C2 21    .3H   .1HL           M82C2 C 2MK82  C 1461CQ   1
164 12 QM82C2C                           461CS   1MB4   X 1
165 12AQM82C2                     RCS-1 1
166 12 QM82D2 21    .3H   .1HL           M82D2 C 2MK82  C 1461CQ   1
167 12 QM82D2C                           461CS   1MB4   X 1
168 12AQM82D2                     RCS-1 1
169 12 QM82E2 21    .3H   .1HL           M82E2 C 2MK82  C 1461CQ   1
170 12 QM82E2C                           461CS   1MB4   X 1
171 12AQM82E2                     RCS-1 1
172 12 QM82A3 21    .3H   .1HL           M82A3 C 2MK82  C 1461CQ   1
173 12 QM82A3C                           461CS   1MB4   X 1
174 12AQM82A3                     RCS-1 1
175 12 QM82B3 21    .3H   .1HL           M82B3 C 2MK82  C 1461CQ   1
176 12 QM82B3C                           461CS   1MB4   X 1
177 12AQM82B3                     RCS-1 1
178 12 QM82C3 21    .3H   .1HL           M82C3 C 2MK82  C 1461CQ   1
179 12 QM82C3C                           461CS   1MB4   X 1
180 12AQM82C3                     RCS-1 1
181 12 QM82D3 21    .3H   .1HL           M82D3 C 2MK82  C 1461CQ   1
182 12 QM82D3C                           461CS   1MB4   X 1
183 12AQM82D3                     RCS-1 1
184 12 QM82E3 21    .3H   .1HL           M82E3 C 2MK82  C 1461CQ   1
185 12 QM82E3C                           461CS   1MB4   X 1
186 12AQM82E3                     RCS-1 1
187 12 6HOLDA 21                  *HOLDA
188 12 6HOLDB 21                  *HOLDB
189 12 6HOLDC 21                  *HOLDC
190 12 6HOLDD 21                  *HOLDD
191 12 6HOLDE 21                  *HOLDE
192 12 6MHU12 21                  *MHU12
193 12 6MHU85 21                  *MHU85
194 12 6MHU11 21                  *MHU11
195 12 6MHU12 21                  *MHU12
196 12 6MK82  21                  *MK82
197 12 TMK81A 21                         MK82   24
198 12 TMK82A 21                         MK82   48
199 12 TMK83A 21                         MK82   72
200 12 TMK84A 21                         MK82   96
201 12 TMK85A 21                         MK82   12
202 12 ENTER  21
203 12 TBLDA1 21                         BLDA1 C29
204 12 TBLDA2 21                         BLDA2 C29
205 12 TBLDA3 21                         BLDA3 C29
206 12 TBLDA4 21                         BLDA4 C29
207 12 TBLDA5 21                         BLDA5 C29
208 12 QPMK82 21                         PMK82 C 1
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209	12 Q82FIN	21				82FIN	C	1				
210	12 Q82BST	21				82BST	C	1.				
211	12 Q82FUS	21				82FUS	C	1				
212	12 GBLDA1	21			◆BLDA1							
213	12 GBLDA2	21			◆BLDA2							
214	12 GBLDA3	21			◆BLDA3							
215	12 GBLDA4	21			◆BLDA4							
216	12 GBLDA5	21			◆BLDA5							
217	12 MK8201	22	1.0H	.1HN		461SQ		1461SS	X	25TON	C	1
218	12 MK8201C					25FLB	C	14FORKSX		1		
219	12AMK8201				RCS-3	1461SQ		2461SS		1		
220	12AMK8201				RCS-4	2461SQ		3				
221	12 MK82A1	22	1.0H	.1HN		461SQ		1461SS	X	210TON	C	1
222	12 MK82A1C					25FLB	C	14FORKSX		1		
223	12AMK82A1				RCS-3	1						
224	12AMK82A1				RCS-4	2						
225	12 MK82B1	22	1.0H	.1HN		461SQ		1461SS	X	25TON	C	1
226	12 MK82B1C					40FLB	C	14FORKSX		1		
227	12AMK82B1				RCS-3	1						
228	12AMK82B1				RCS-4	2						
229	12 MK82C1	22	1.0H	.1HN		461SQ		1461SS	X	210TON	C	1
230	12 MK82C1C					40FLB	C	14FORKSX		1		
231	12AMK82C1				RCS-3	1						
232	12AMK82C1				RCS-4	2						
233	12 MK82D1	22	1.0H	.1HN		461SQ		1461SS	X	21HTON	C	1
234	12 MK82D1C					4FORKSX		1				
235	12AMK82D1				RCS-3	1						
236	12AMK82D1				RCS-4	2						
237	12 MK82E1	22	1.0H	.1HN		461SQ		1461SS	X	22HTON	C	1
238	12 MK82E1C					4FORKSX		1				
239	12AMK82E1				RCS-3	1						
240	12AMK82E1				RCS-4	2						
241	12 DELIV1	22	.3H	.1HN		461SQ		1461SS	X	1		
242	12ADELIV1	22			RCS-2	1461SQ		2				
243	12 MK8203	22	1.0H	.1HN		461SQ		1461SS	X	24FORKCX		1
244	12AMK8203				RCS-3	1						
245	12AMK8203				RCS-4	2						
246	12 MK8204	22	1.2H	.1HN		461CQ		1461CS	X	3H-11	X	1
247	12AMK8204				RCS-5	1461CQ		2461CS		2		
248	12AMK8204				RCS-6	2461CQ		3461CS		1		
249	12AMK8204				RCS-7	3461CQ		4				
250	12 G5TON	21			◆5TON							
251	12 G10TON	21			◆10TON							
252	12 G25FLB	21			◆25FLB							
253	12 G40FLB	21			◆40FLB							
254	12 G2HTON	21			◆2HTON							
255	12 G1HTON	21			◆1HTON							
256	12 MK82D5	22	.75H	.1HN		461SQ		1461SS	X	21HTON	C	1
257	12 MK82D5C					4FORKSX		1				
258	12AMK82D5				RCS-3	1						
259	12AMK82D5				RCS-4	2						
260	12 MK8205	22	.75H	.1HN		461SQ		1461SS	X	25TON	C	1

261	12 MK8205C					25FLB C 14FORKSX 1
262	12AMK8205				RCS-3	1
263	12AMK8205				RCS-4	2
264	12 MK82A5	22	.75H	.1HN		461SQ 1461SS X 210TON C 1
265	12 MK82A5C					25FLB C 14FORKSX 1
266	12AMK82A5				RCS-3	1
267	12AMK82A5				RCS-4	2
268	12 MK82B5	22	.75H	.1HN		461SQ 1461SS X 25TON C 1
269	12 MK82B5C					40FLB C 14FORKSX 1
270	12AMK82B5				RCS-3	1
271	12AMK82B5				RCS-4	2
272	12 MK82C5	22	.75H	.1HN		461SQ 1461SS X 210TON C 1
273	12 MK82C5C					40FLB C 14FORKSX 1
274	12AMK82C5				RCS-3	1
275	12AMK82C5				RCS-4	2
276	12 MK82E5	22	.75H	.1HN		461SQ 1461SS X 22HTON C 1
277	12 MK82E5C					4FORKSX 1
278	12AMK82E5				RCS-3	1
279	12AMK82E5				RCS-4	2
280	12 MK8213	22	.2H	.1HN		461SQ 1461SS X 24FORKCX 1
281	12AMK8213				RCS-3	1
282	12AMK8213				RCS-4	2
283	12 MK8218	22	3.2H	.1HN		461CQ 1461CS X 2
284	12AMK8218				RCS-8	1461CQ 2461CS 1
285	12AMK8218				RCS-9	2461CQ 3
286	12 MK8219	22	1.1H	.1HN		461CQ 1461CS X 2H-11 X 1
287	12AMK8219				RCS-8	1
288	12AMK8219				RCS-9	2
289	12 QMHU12	21				MHU12 C 1
290	12 GM82A1	21	.3H	.1HN	◆M82A1	HOLDA C 4MB4 X 1461CQ 1
291	12 GM82A1C					461CS X 1
292	12AGM82A1				RCS-1	1
293	12 GM82B1	21	.3H	.1HN	◆M82B1	HOLDB C 4MB4 X 1461CQ 1
294	12 GM82B1C					461CS X 1
295	12AGM82B1				RCS-1	1
296	12 GM82C1	21	.3H	.1HN	◆M82C1	HOLDC C 4MB4 X 1461CQ 1
297	12 GM82C1C					461CS X 1
298	12AGM82C1				RCS-1	1
299	12 GM82D1	21	.3H	.1HN	◆M82D1	HOLDD C 4MB4 X 1461CQ 1
300	12 GM82D1C					461CS X 1
301	12AGM82D1				RCS-1	1
302	12 GM82E1	21	.3H	.1HN	◆M82E1	HOLDE C 4MB4 X 1461CQ 1
303	12 GM82E1C					461CS X 1
304	12AGM82E1				RCS-1	1
305	12 QMHU85	21				MHU85 C 1
306	12 GM82A2	21	.3H	.1HN	◆M82A2	HOLDA C 4MB4 X 1461CQ 1
307	12 GM82A2C					461CS X 1
308	12AGM82A2				RCS-1	1
309	12 GM82B2	21	.3H	.1HN	◆M82B2	HOLDB C 4MB4 X 1461CQ 1
310	12 GM82B2C					461CS X 1
311	12AGM82B2				RCS-1	1
312	12 GM82C2	21	.3H	.1HN	◆M82C2	HOLDC C 4MB4 X 1461CQ 1

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313 12 GM82C2C                                    461CS X 1
314 12AGM82C2                            RCS-1 1
315 12 GM82D2 21      .3H     .1HN  *M82D2   HOLDD C 4MB4     X 1461CQ     1
316 12 GM82D2C                                    461CS X 1
317 12AGM82D2                            RCS-1 1
318 12 GM82E2 21      .3H     .1HN  *M82E2   HOLDE C 4MB4     X 1461CQ     1
319 12 GM82E2C                                    461CS X 1
320 12AGM82E2                            RCS-1 1
321 12 QMHU11 21                                  MHU11 C 1
322 12 GM82A3 21      .3H     .1HN  *M82A3   HOLDA C 4MB4     X 1461CQ     1
323 12 GM82A3C                                    461CS X 1
324. 12AGM82A3                           RCS-1 1
325 12 GM82B3 21      .3H     .1HN  *M82B3   HOLDB C 4MB4     X 1461CQ     1
326 12 GM82B3C                                    461CS X 1
327 12AGM82B3                            RCS-1 1
328 12 GM82C3 21      .3H     .1HN  *M82C3   HOLDC C 4MB4     X 1461CQ     1
329 12 GM82C3C                                    461CS X 1
330 12AGM82C3                            RCS-1 1
331 12 GM82D3 21      .3H     .1HN  *M82D3   HOLDD C 4MB4     X 1461CQ     1
332 12 GM82D3C                                    461CS X 1
333 12AGM82D3                            RCS-1 1
334 12 GM82E3 21      .3H     .1HN  *M82E3   HOLDE C 4MB4     X 1461CQ     1
335 12 GM82E3C                                    461CS X 1
336 12AGM82E3                            RCS-1 1
337 12 DCMTA  21                    *
338 12 LD20MM 21      .2H     .1HL               462X0    2
339 12 Q20MD1 21      .3H     .1HL               20MD1 C 120MM   C 1461CQ     1
340 12 Q20MD1C                                   461CS    11HTON X 1
341 12AQ20MD1                            RCS-1 1
342 12 Q20MB1 21      .3H     .1HL               20MB1 C 120MM   C 1461CQ     1
343 12 Q20MB1C                                   461CS    11HTON X 1
344 12AQ20MB1                            RCS-1 1
345 12 GHLD2D 21                    *HOLDD
346 12 GHLD2B 21                    *HOLDB
347 12 T20M1A 21                                 20MM    24
348 12 T20M2A 21                                 20MM    48
349 12 T20M3A 21                                 20MM    72
350 12 T20M4A 21                                 20MM    96
351 12 T20M5A 21                                 20MM    12
352 12 TBLDB1 21                                 BLDB1 C28
353 12 TBLDB2 21                                 BLDB2 C28
354 12 TBLDB3 21                                 BLDB3 C28
355 12 TBLDB4 21                                 BLDB4 C28
356 12 TBL2A1 21                                 BLDA1 C28
357 12 G20MM  21                    *20MM
358 12 QP20MM 21                                 P20MM C 1
359 12 GBLDB1 21                    *BLDB1
360 12 GBLDB2 21                    *BLDB2
361 12 GBLDB3 21                    *BLDB3
362 12 GBLDB4 21                    *BLDB4
363 12 GBL2A1 21                    *BLDA1
364 12 20MMA1 22     2.3H     .2HN               461SQ    1461SS X [illegible]5TON   C 1
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365 12 20MMA1C                                    25FLB C 14FORKSX 1
366 12A20MMA1                             RCS-3 1
367 12A20MMA1                             RCS-4 2
368 12 20MMB1 22    2.3H    .2HN                  461SQ    1461SS X 25TON   C 1
369 12 20MMB1C                                    40FLB C 14FORKSX 1
370 12A20MMB1                             RCS-3 1
371 12A20MMB1                             RCS-4 2
372 12 20MMC1 22    2.3H    .2HN                  461SQ    1461SS X 210TON C 1
373 12 20MMC1C                                    25FLB C 14FORKSX 1
374 12A20MMC1                             RCS-3 1
375 12A20MMC1                             RCS-4 2
376 12 20MMD1 22    2.3H    .2HN                  461SQ    1461SS X 210TON C 1
377 12 20MMD1C                                    40FLB C 14FORKSX 1
378 12A20MMD1                             RCS-3 1
379 12A20MMD1                             RCS-4 2
380 12 20MME1 22    2.3H    .2HN                  461SQ    1461SS X 21HTON C 1
381 12 20MME1C                                    4FORKSX 1
382 12A20MME1                             RCS-3 1
383 12A20MME1                             RCS-4 2
384 12 20MMF1 22    2.3H    .2HN                  461SQ    1461SS X 22HTON C 1
385 12 20MMF1C                                    4FORKSX 1
386 12A20MMF1                             RCS-3 1
387 12A20MMF1                             RCS-4 2
388 12 20MM03 22   1.75H    .2HN                  461SQ    1461SS X 24FORKCX 1
389 12A20MM03                             RCS-2 1
390 12 20MM05 22     .5H    .1HN                  461CQ    1461CS X 24FORKCX 1
391 12A20MM05                             RCS-1 1
392 12 20MM04 22   10.5H   1.0HN                  461CQ    1461CS X 24FORKCX 1
393 12A20MM04                             RCS-1 1
394 12 G20MD1 21     .3H    .1HN ◆20MD1   HOLDD C 21HTON X 1461CQ    1
395 12 G20MD1C                                    461CS X 1
396 12AG20MD1                             RCS-1 1
397 12 G20MB1 21     .3H    .1HN ◆20MB1   HOLDB C 21HTON X 1461CQ    1
398 12 G20MB1C                                    461CS X 1
399 12AG20MB1                             RCS-1 1
400 12 DCMTB   21                        ◆
401 12 LDAIM9 21     .2H    .1HL                  462X0    4
402 12 QAIM9C 21     .3H    .1HL                  AIM9C C 1AIM9   C 1461CQ    1
403 12 QAIM9CC                                    461CS    11HTON X 1
404 12AQAIM9C                             RCS-1 1
405 12 QAIM9E 21     .3H    .1HL                  AIM9E C 1AIM9   C 1461CQ    1
406 12 QAIM9EC                                    461CS    11HTON X 1
407 12AQAIM9E                             RCS-1 1
408 12 GHLD2C 21                         ◆HOLDC
409 12 GHLD2E 21                         ◆HOLDE
410 12 TAIM91 21                                  AIM9   24
411 12 TAIM92 21                                  AIM9   48
412 12 TAIM93 21                                  AIM9   72
413 12 TAIM94 21                                  AIM9   96
414 12 TAIM95 21                                  AIM9   12
415 12 TBLDC1 21                                  BLDC1 C 6
416 12 TBL2A5 21                                  BLDA5 C 6
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417 12 6AIM9  21                    *AIM9
418 12 QPAIM9 21                              PAIM9 C 1
419 12 6BLDC1 21                    *BLDC1
420 12 6BL2A5 21                    *BLDA5
421 12 AIM9A1 22   2.0H    .2HN               461SQ    1461SS X 210TON C 1
422 12 AIM9A1C                                25FLB C 14FORKSX 1
423 12AAIM9A1                        RCS-3 1
424 12AAIM9A1                        RCS-4 2
425 12 AIM9B1 22   2.0H    .2HN               461SQ    1461SS X 25TON  C 1
426 12 AIM9B1C                                25FLB C 14FORKSX 1
427 12AAIM9B1                        RCS-3 1
428 12AAIM9B1                        RCS-4 2
429 12 AIM9C1 22   2.0H    .2HN               461SQ    1461SS X 21HTON C 1
430 12 AIM9C1C                                4FORKSX 1
431 12AAIM9C1                        RCS-3 1
432 12AAIM9C1                        RCS-4 2
433 12 AIM903 22   2.0H    .2HN               461SQ    1461SS X 24FORKCX 1
434 12AAIM903                        RCS-3 1
435 12AAIM903                        RCS-4 2
436 12 AIM904 22   1.5H    .2HN               461CQ    1461CS X 3
437 12AAIM904                        RCS-5 1
438 12AAIM904                        RCS-6 2
439 12AAIM904                        RCS-7 2
440 12 6AIM9C 21    .3H    .1HN *AIM9C  HOLDC C 11HTON X 1461CQ    1
441 12 6AIM9CC                                461CS X 1
442 12A6AIM9C                        RCS-1 1
443 12 6AIM9E 21    .3H    .1HN *AIM9E  HOLDE C 11HTON X 1461CQ    1
444 12 6AIM9EC                                461CS X 1
445 12A6AIM9E                        RCS-1 1
446 12 DCMTC  21                    *
447 12 TIME   21    .5H       C     *
448 12 RMB4   21   1.0H    .2HN               MB4      1
449 12 R5TON  21   1.0H    .2HN               5TON     1
450 12 R10TON 21   1.0H    .2HN               10TON    1
451 12 R25FLB 21   1.0H    .2HN               25FLB    1
452 12 R40FLB 21   1.0H    .2HN               40FLB    1
453 12 R4FORS 21   1.0H    .2HN               4FORKS   1
454 12 R6FORS 21   1.0H    .2HN               6FORKS   1
455 12 R10FRS 21   1.0H    .2HN               10FORS   1
456 12 RH-11  21   1.0H    .2HN               H-11     1
457 12 RJAMR  21   1.0H    .2HN               JAMER    1
458 12 R4FORC 21   1.0H    .2HN               4FORKC   1
459 12 R6FORC 21   1.0H    .2HN               6FORKC   1
460 12 R10FRC 21   1.0H    .2HN               10FORC   1
461 12 R1HTON 21   1.0H    .2HN               1HTON    1
462 12 R2HTON 21   1.0H    .2HN               2HTON    1
463 12 RMHU12 21   1.0H    .2HN               MHU12    1
464 12 RMHU11 21   1.0H    .2HN               MHU11    1
465 12 RMHU85 21   1.0H    .2HN               MHU85    1
466 11
467 11 MN0001 PREFLT MN0002 D
468 11 MN0002 COMUN  MN0003 C
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469	11	MN0002	R	BMUN	E	1.000
470	11	MN0002			E	0.000
471	11	MN0003	SORTIE	MN0005	D	
472	11	MN0005	PSTFLT	MN0006	D	
473	11	MN0006	REFUEL	MN0001	D	
474	11	CQMUN		CQMK82	D	
475	11	CQMK82	QM82A1	CQMK10	R	
476	11	CQMK82	QM82B1	CQMK11	R	
477	11	CQMK82	QM82C1	CQMK12	R	
478	11	CQMK82	QM82D1	CQMK13	R	
479	11	CQMK82	QM82E1	CQMK14	R	
480	11	CQMK10	CHOLDA	CQMK15	C	
481	11	CQMK11	CHOLDB	CQMK15	C	
482	11	CQMK12	CHOLDC	CQMK15	C	
483	11	CQMK13	CHOLDD	CQMK15	C	
484	11	CQMK14	CHOLDE	CQMK15	C	
485	11	CQMK15	LDMK82	CQMK16	D	
486	11	CQMK16	CMHU12		C	
487	11	CQMK82	QM82A2	CQMK20	R	
488	11	CQMK82	QM82B2	CQMK21	R	
489	11	CQMK82	QM82C2	CQMK22	R	
490	11	CQMK82	QM82D2	CQMK23	R	
491	11	CQMK82	QM82E2	CQMK24	R	
492	11	CQMK20	CHOLDA	CQMK25	C	
493	11	CQMK21	CHOLDB	CQMK25	C	
494	11	CQMK22	CHOLDC	CQMK25	C	
495	11	CQMK23	CHOLDD	CQMK25	C	
496	11	CQMK24	CHOLDE	CQMK25	C	
497	11	CQMK25	LDMK82	CQMK26	D	
498	11	CQMK26	CMHU65		C	
499	11	CQMK82	QM82A3	CQMK30	R	
500	11	CQMK82	QM82B3	CQMK31	R	
501	11	CQMK82	QM82C3	CQMK32	R	
502	11	CQMK82	QM82D3	CQMK33	R	
503	11	CQMK82	QM82E3	CQMK34	R	
504	11	CQMK30	CHOLDA	CQMK35	C	
505	11	CQMK31	CHOLDB	CQMK35	C	
506	11	CQMK32	CHOLDC	CQMK35	C	
507	11	CQMK33	CHOLDD	CQMK35	C	
508	11	CQMK34	CHOLDE	CQMK35	C	
509	11	CQMK35	LDMK82	CQMK36	D	
510	11	CQMK36	CMHU11		C	
511	11	CHOLDA	GHOLDA	CHOLD1	D	
512	11	CHOLD1		CHOLDA	HHOLDA	
513	11	CHOLDB	GHOLDB	CHOLD2	D	
514	11	CHOLD2		CHOLDB	HHOLDB	
515	11	CHOLDC	GHOLDC	CHOLD3	D	
516	11	CHOLD3		CHOLDC	HHOLDC	
517	11	CHOLDD	GHOLDD	CHOLD4	D	
518	11	CHOLD4		CHOLDD	HHOLDD	
519	11	CHOLDE	GHOLDE	CHOLD5	D	
520	11	CHOLD5		CHOLDE	HHOLDE	

521	11	CMHU12	GMH112	CMHU01	D	
522	11	CMHU01		CMHU12	HHMHU12	
523	11	CMHU85	GMHU85	CMHU02	D	
524	11	CMHU02		CMHU85	HHMHU85	
525	11	CMHU11	GMHU11	CMHU03	D	
526	11	CMHU03		CMHU11	HHMHU11	
527	11	CGMK82	GMK82	CGMK80	D	
528	11	CGMK80		CGMK82	HHMK82	
529	11	BMUN		BMK82	D	
530	11	BMK82	TMK81A		R	
531	11	BMK82	ENTER	BMK801	R	
532	11	BMK801	TBLDA1	BMK802	R	
533	11	BMK801	TBLDA2	BMK803	R	
534	11	BMK801	TBLDA3	BMK804	R	
535	11	BMK801	TBLDA4	BMK805	R	
536	11	BMK801	TBLDA5	BMK806	R	
537	11	BMK802	CPMK82	BMK807	C	
538	11	BMK803	CPMK82	BMK808	C	
539	11	BMK804	CPMK82	BMK809	C	
540	11	BMK805	CPMK82	BMK810	C	
541	11	BMK806	CPMK82	BMK811	C	
542	11	BMK807	CGMK82	BMK812	C	
543	11	BMK808	CGMK82	BMK813	C	
544	11	BMK809	CGMK82	BMK814	C	
545	11	BMK810	CGMK82	BMK815	C	
546	11	BMK811	CGMK82	BMK816	C	
547	11	BMK812	CMK82	BMK82D	C	
548	11	BMK812		BMK82	D	
549	11	BMK813	CMK82	BMK82E	C	
550	11	BMK813		BMK82	D	
551	11	BMK814	CMK82	BMK82F	C	
552	11	BMK814		BMK82	D	
553	11	BMK815	CMK82	BMK826	C	
554	11	BMK815		BMK82	D	
555	11	BMK816	CMK82	BMK82H	C	
556	11	BMK816		BMK82	D	
557	11	CPMK82	QPMK82	PMK801	D	
558	11	PMK801	Q82FIN	PMK802	E	.565
559	11	PMK801		PMK802	E	.435
560	11	PMK802	Q82BST	PMK803	E	.240
561	11	PMK802		PMK803	E	.760
562	11	PMK803	Q82FUS		A	.470
563	11	BMK82D	GBLDA1	BMK001	D	
564	11	BMK001		BMK82D	HHBLDA1	
565	11	BMK82E	GBLDA2	BMK002	D	
566	11	BMK002		BMK82E	HHBLDA2	
567	11	BMK82F	GBLDA3	BMK003	D	
568	11	BMK003		BMK82F	HHBLDA3	
569	11	BMK826	GBLDA4	BMK004	D	
570	11	BMK004		BMK826	HHBLDA4	
571	11	BMK82H	GBLDA5	BMK005	D	
572	11	BMK005		BMK82H	HHBLDA5	

573	11	CMK82	CDMK82	BMK82A	C	
574	11	CDMK82		BMK821	D	
575	11	BMK821	MK8201	BMK822	R	
576	11	BMK821	MK82A1	BMK823	R	
577	11	BMK821	MK82B1	BMK824	R	
578	11	BMK821	MK82C1	BMK825	R	
579	11	BMK822	DELIV1	BMK826	D	
580	11	BMK823	DELIV1	BMK827	D	
581	11	BMK824	DELIV1	BMK828	D	
582	11	BMK825	DELIV1	BMK829	D	
583	11	BMK826	MK8203	BMK830	D	
584	11	BMK827	MK8203	BMK831	D	
585	11	BMK828	MK8203	BMK832	D	
586	11	BMK829	MK8203	BMK833	D	
587	11	BMK830	MK8204		D	
588	11	BMK830	65TON	BMK834	D	
589	11	BMK834	625FLB		D	
590	11	BMK831	MK8204		D	
591	11	BMK831	610TON	BMK835	D	
592	11	BMK835	625FLB		D	
593	11	BMK832	MK8204		D	
594	11	BMK832	65TON	BMK836	D	
595	11	BMK836	640FLB		D	
596	11	BMK833	MK8204		D	
597	11	BMK833	610TON	BMK837	D	
598	11	BMK837	640FLB		D	
599	11	CDMK82		BMK840	A	.565
600	11	BMK840	MK82C5	BMK841	R	
601	11	BMK840	MK82A5	BMK842	R	
602	11	BMK840	MK82B5	BMK843	R	
603	11	BMK840	MK8205	BMK844	R	
604	11	BMK840	MK82D5	BMK845	R	
605	11	BMK840	MK82E5	BMK846	R	
606	11	BMK841	DELIV1	BMK847	D	
607	11	BMK842	DELIV1	BMK848	D	
608	11	BMK843	DELIV1	BMK849	D	
609	11	BMK844	DELIV1	BMK850	D	
610	11	BMK845	DELIV1	BMK851	D	
611	11	BMK846	DELIV1	BMK852	D	
612	11	BMK847	MK8203	BMK853	D	
613	11	BMK848	MK8203	BMK854	D	
614	11	BMK849	MK8203	BMK855	D	
615	11	BMK850	MK8203	BMK856	D	
616	11	BMK851	MK8203	BMK857	D	
617	11	BMK852	MK8203	BMK858	D	
618	11	BMK853	610TON	BMK859	D	
619	11	BMK859	640FLB		D	
620	11	BMK854	610TON	BMK860	D	
621	11	BMK860	625FLB		D	
622	11	BMK855	65TON	BMK861	D	
623	11	BMK861	640FLB		D	
624	11	BMK856	65TON	BMK862	D	

625	11	BMK862	625FLB		D	
626	11	BMK857	G1HTON		D	
627	11	BMK858	G2HTON		D	
628	11	CDMK82		BMK870	A	.240
629	11	BMK870	MK82A5	BMK842	R	
630	11	BMK870	MK82B5	BMK843	R	
631	11	BMK870	MK82C5	BMK841	R	
632	11	BMK870	MK82D5	BMK844	R	
633	11	BMK870	MK82E5	BMK846	R	
634	11	BMK870	MK82D5	BMK845	R	
635	11	CDMK82		B82100	A	.470
636	11	B82100	MK82B1	B82001	R	
637	11	B82100	MK82C1	B82002	R	
638	11	B82100	MK82A1	B82003	R	
639	11	B82100	MK82D1	B82004	R	
640	11	B82100	MK82D1	B82005	R	
641	11	B82100	MK82E1	B82006	R	
642	11	B82001	DELIV1	B82007	D	
643	11	B82002	DELIV1	B82008	D	
644	11	B82003	DELIV1	B82009	D	
645	11	B82004	DELIV1	B82010	D	
646	11	B82005	DELIV1	B82011	D	
647	11	B82006	DELIV1	B82012	D	
648	11	B82007	MK8213	BMK855	D	
649	11	B82008	MK8213	BMK853	D	
650	11	B82009	MK8213	BMK854	D	
651	11	B82010	MK8213	BMK856	D	
652	11	B82011	MK8213	BMK851	D	
653	11	B82012	MK8213	BMK852	D	
654	11	BMK82A	MK8218	B82120	D	
655	11	BMK82A	MK8218		D	
656	11	B82120	QMHU12	B82119	R	
657	11	B82119	MK8219	B82121	D	
658	11	B82121	6M82A1	B82124	R	
659	11	B82121	6M82B1	B82124	R	
660	11	B82121	6M82C1	B82124	R	
661	11	B82121	6M82D1	B82124	R	
662	11	B82121	6M82E1	B82124	R	
663	11	B82120	QMHU85	B8212A	R	
664	11	B8212A	MK8219	B82122	D	
665	11	B82122	6M82A2	B82124	R	
666	11	B82122	6M82B2	B62124	R	
667	11	B82122	6M82C2	B82124	R	
668	11	B82122	6M82D2	B82124	R	
669	11	B82122	6M82E2	B82124	R	
670	11	B82120	QMHU11	B8212B	R	
671	11	B8212B	MK8219	B82123	D	
672	11	B82123	6M82A3	B82124	R	
673	11	B82123	6M82B3	B82124	R	
674	11	B82123	6M82C3	B82124	R	
675	11	B82123	6M82D3	B82124	R	
676	11	B82123	6M82E3	B82124	R	

677	11	B82124	DCMTA	B82125	D	
678	11	B82125		B82120	HHRMK82	
679	11	CQMUN		CQ20MM	D	
680	11	CQ20MM	LD20MM		E	.500
681	11	CQ20MM		C20M01	E	.500
682	11	C20M01	Q20MD1	C20M10	R	
683	11	C20M01	Q20MB1	C20M11	R	
684	11	C20M10	CHLD2D	C20M15	C	
685	11	C20M11	CHLD2B	C20M15	C	
686	11	C20M15	LD20MM	C20M16	D	
687	11	C20M16	GMHU12		D	
688	11	CHLD2D	GHLD2D	CHLD21	D	
689	11	CHLD21		CHLD2D	HHLD2D	
690	11	CHLD2B	GHLD2B	CHLD22	D	
691	11	CHLD22		CHLD2B	HHLD2B	
692	11	BMUN		B20M01	D	
693	11	B20M01	T20M5A		R	
694	11	B20M01	ENTER	B20M02	R	
695	11	B20M02	TBLDB1	B20M03	R	
696	11	B20M02	TBLDB2	B20M04	R	
697	11	B20M02	TBLDB3	B20M05	R	
698	11	B20M02	TBLDB4	B20M06	R	
699	11	B20M02	TBL2A1	B20M07	R	
700	11	B20M03	QP20MM	B20M08	D	
701	11	B20M04	QP20MM	B20M09	D	
702	11	B20M05	QP20MM	B20M10	D	
703	11	B20M06	QP20MM	B20M11	D	
704	11	B20M07	QP20MM	B20M12	D	
705	11	B20M08	CG20MM	B20M13	C	
706	11	B20M09	CG20MM	B20M14	C	
707	11	B20M10	CG20MM	B20M15	C	
708	11	B20M11	CG20MM	B20M16	C	
709	11	B20M12	CG20MM	B20M17	C	
710	11	B20M13	C20MM	B20M18	C	
711	11	B20M13		B20M01	D	
712	11	B20M14	C20MM	B20M19	C	
713	11	B20M14		B20M01	D	
714	11	B20M15	C20MM	B20M20	C	
715	11	B20M15		B20M01	D	
716	11	B20M16	C20MM	B20M21	C	
717	11	B20M16		B20M01	D	
718	11	B20M17	C20MM	B20M22	C	
719	11	B20M17		B20M01	D	
720	11	B20M18	GBLDB1	B20M23	D	
721	11	B20M23		B20M18	HHBLDB1	
722	11	B20M19	GBLDB2	B20M24	D	
723	11	B20M24		B20M19	HHBLDB2	
724	11	B20M20	GBLDB3	B20M25	D	
725	11	B20M25		B20M20	HHBLDB3	
726	11	B20M21	GBLDB4	B20M26	D	
727	11	B20M26		B20M21	HHBLDB4	
728	11	B20M22	GBL2A1	B20M27	D	

729	11	B20M27		B20M22	HHBL2A1
730	11	C620MM	620MM	C620M1	D
731	11	C620M1		C620MM	HH620MM
732	11	C20MM	CD20MM	B20M50	C
733	11	CD20MM	20MMA1	B20M31	R
734	11	CD20MM	20MMB1	B20M32	R
735	11	CD20MM	20MMC1	B20M33	R
736	11	CD20MM	20MMD1	B20M34	R
737	11	CD20MM	20MME1	B20M35	R
738	11	CD20MM	20MMF1	B20M36	R
739	11	B20M31	DELIV1	B20M37	D
740	11	B20M32	DELIV1	B20M38	D
741	11	B20M33	DELIV1	B20M39	D
742	11	B20M34	DELIV1	B20M40	D
743	11	B20M35	DELIV1	B20M41	D
744	11	B20M36	DELIV1	B20M42	D
745	11	B20M37	20MM03	BMK856	D
746	11	B20M38	20MM03	BMK855	D
747	11	B20M39	20MM03	BMK854	D
748	11	B20M40	20MM03	BMK853	D
749	11	B20M41	20MM03	BMK857	D
750	11	B20M42	20MM03	BMK858	D
751	11	B20M50	20MM04	B20M51	D
752	11	B20M51	OMHU12	B20M52	D
753	11	B20M52	20MM05	B20M53	D
754	11	B20M53	620MD1	B20M54	R
755	11	B20M53	620MB1	B20M54	R
756	11	B20M54	DCMTB	B20M55	D
757	11	B20M55		B20M51	HHR20MM
758	11	CQMUN		CQAIM9	D
759	11	CQAIM9	QAIM9E	CAM902	R
760	11	CQAIM9	QAIM9C	CAM901	R
761	11	CAM901	CHLD2C	CAM903	C
762	11	CAM902	CHLD2E	CAM903	C
763	11	CAM903	LDAIM9	CAM904	D
764	11	CAM904	6MHU12		D
765	11	CHLD2C	6HLD2C	CHLD31	D
766	11	CHLD31		CHLD2C	HHLD2C
767	11	CHLD2E	6HLD2E	CHLD32	D
768	11	CHLD32		CHLD2E	HHLD2E
769	11	BMUN		BAM901	D
770	11	BAM901	TAIM91		R
771	11	BAM901	ENTER	BAM902	R
772	11	BAM902	TBLDC1	BAM903	R
773	11	BAM902	TBL2A5	BAM904	R
774	11	BAM903	QPAIM9	BAM905	D
775	11	BAM904	QPAIM9	BAM906	D
776	11	BAM905	CGAIM9	BAM907	C
777	11	BAM906	CGAIM9	BAM908	C
778	11	BAM907	CAIM9	BAM909	C
779	11	BAM907		BAM901	D
780	11	BAM908	CAIM9	BAM910	C

781	11	BAM908		BAM901	D
782	11	BAM909	GBLDC1	BAM911	D
783	11	BAM911		BAM909	HHBLDC1
784	11	BAM910	GBL2A5	BAM912	D
785	11	BAM912		BAM910	HHBL2A5
786	11	CGAIM9	GAIM9	CGAM91	D
787	11	CGAM91		CGAIM9	HHGAIM9
788	11	CAIM9	CDAIM9	BAM930	C
789	11	CDAIM9	AIM9A1	BAM920	R
790	11	CDAIM9	AIM9B1	BAM921	R
791	11	CDAIM9	AIM9C1	BAM922	R
792	11	BAM920	DELIV1	BAM923	D
793	11	BAM921	DELIV1	BAM924	D
794	11	BAM922	DELIV1	BAM925	D
795	11	BAM923	AIM903	BMK854	D
796	11	BAM924	AIM903	BMK356	D
797	11	BAM925	AIM903	BMK857	D
798	11	BAM930	QMHU12	BAM931	D
799	11	BAM931	AIM904		D
800	11	BAM931	AIM904	BAM932	D
801	11	BAM932	GAIM9E	BAM933	R
802	11	BAM932	GAIM9C	BAM933	R
803	11	BAM933	DCMTC	BAM934	D
804	11	BAM934		BAM930	HHRAIM9
805	11	TIMER1	TIME	TIMER2	D
806	11	TIMER2		TIMER1	D
807	11	TIMER2		MB4001	FFMB4
808	11	MB4001	RMB4		D
809	11	TIMER2		5TON1	FF5TON
810	11	5TON1	R5TON		D
811	11	TIMER2		10TON1	FF10TON
812	11	10TON1	R10TON		D
813	11	TIMER2		25FLB1	FF25FLB
814	11	25FLB1	R25FLB		D
815	11	TIMER2		40FLB1	FF40FLB
816	11	40FLB1	R40FLB		D
817	11	TIMER2		4FORS1	FF4FORS
818	11	4FORS1	R4FORS		D
819	11	TIMER2		6FORS1	FF6FORS
820	11	6FORS1	R6FORS		D
821	11	TIMER2		10FRS1	FF10FRS
822	11	10FRS1	R10FRS		D
823	11	TIMER2		H-1101	FFH-11
824	11	H-1101	RH-11		D
825	11	TIMER2		JAMR01	FFJAMR
826	11	JAMR01	RJAMR		D
827	11	TIMER2		4FORC1	FF4FORC
828	11	4FORC1	R4FORC		D
829	11	TIMER2		6FORC1	FF6FORC
830	11	6FORC1	R6FORC		D
831	11	TIMER2		10FRC1	FF10FRC
832	11	10FRC1	R10FRC		D

833	11	TIMER2		1HTON1	FF1HTON
834	11	1HTON1	R1HTON		D
835	11	TIMER2		2HTON1	FF2HTON
836	11	2HTON1	R2HTON		D
837	11	TIMER2		MHU111	FFMHU11
838	11	MHU111	RMHU11		D
839	11	TIMER2		MHU851	FFMHU85
840	11	MHU851	RMHU85		D
841	11	TIMER2		MHU121	FFMHU12
842	11	MHU121	RMHU12		D
843	14				
844	14	GHOLDA	HOLDA	1.0	
845	14	GHOLDB	HOLDB	1.0	
846	14	GHOLDC	HOLDC	1.0	
847	14	GHOLDD	HOLDD	1.0	
848	14	GHOLDE	HOLDE	1.0	
849	14	GMH112	HMHU12	1.0	
850	14	GMHU85	HMHU85	1.0	
851	14	GMHU11	HMHU11	1.0	
852	14	GBLDA1	HBLDA1	1.0	
853	14	GBLDA2	HBLDA2	1.0	
854	14	GBLDA3	HBLDA3	1.0	
855	14	GBLDA4	HBLDA4	1.0	
856	14	GBLDA5	HBLDA5	1.0	
857	14	GMK82	HMK82	1.0	
858	14	TIME S	FMB4		
859	14		F5TON		
860	14		F10TON		
861	14		F25FLB		
862	14		F40FLB		
863	14		F4FORS		
864	14		F6FORS		
865	14		F10FRS		
866	14		FH-11		
867	14		FJAMR		
868	14		F4FORC		
869	14		F6FORC		
870	14		F10FRC		
871	14		FMHU12		
872	14		FMHU85		
873	14		FMHU11		
874	14		F1HTON		
875	14		F2HTON		
876	14	DCMTA	HRMK82	1.0	
877	14	GHLD2D	HLD2D	1.0	
878	14	GHLD2B	HLD2B	1.0	
879	14	GBLDB1	HBLDB1	1.0	
880	14	5BLDB2	HBLDB2	1.0	
881	14	GBLDB3	HBLDB3	1.0	
892	14	GBLDB4	HBLDB4	1.0	
883	14	GBL2A1	HBL2A1	1.0	
884	14	G20MM	HG20MM	1.0	

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885 14 DCMTB     HR20MM      1.0
886 14 GHLD2C    HLD2C       1.0
887 14 GHLD2E    HLD2E       1.0
888 14 GBLDC1    HBLDC1      1.0
889 14 GBL2A5    HBL2A5      1.0
890 14 GAIM9     HGAIM9      1.0
891 14 DCMTC     HRAIM9      1.0
892 16
893 16 ◆             8    8    8
894 16 R                        7
895 16   431F1    200  200  200
896 16   462X0    200  200  200
897 16   PILOT    200  200  200
898 16   461SQ    200  200  200
899 16   461SS    200  200  200
900 16   461CQ    200  200  200
901 16   461CS    200  200  200
902 17
903 17 CAS      1AMN0001                      TFX
904 17 TIMER    2NTIMER1
905 17 ORDER    3NBMK82
906 18
907 1809 1.1
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Appendix B

SIMULATION RESULTS

Unconstrained Simulation Results

RUN NUMBER ALPHA

P E R F O R M A N C E   S U M M A R Y

PERIOD FROM 0. TO 30.0 LEVEL 2

M I S S I O N S	TOTAL	OTHER
1 NUMBER OF MISSIONS REQUESTED	0.	0.
2 NUMBER ACCOMPLISHED	0.	0.
3 PERCENT ACCOMPLISHED	0.	0.
5 NUMBER OF SORTIES REQUESTED	0.	0.
7 NUMBER ACCOMPLISHED	0.	0.
8 PERCENT ACCOMPLISHED	0.	0.
1 NUMBER OF WEATHER CANCELS	0.	0.
2 NUMBER OF WEATHER DELAYS	0.	0.
3 NUMBER OF ALERT REPLENISHMENT	0.	0.
4 NUMBER OF ATTRITIONS	0.	0.
5 NUMBER OF RAM REPAIRS	0.	0.
6 NUMBER OF AIR ABORTS(TOTAL)	0.	0.
1 AVG. AC POST SORTIE TIME(HRS)	0.	0.
2 NO. OF POST-SORTIES COMPLETED	0.	0.

A C T I V I T I E S	TOTAL	CAS	TIMER	ORDER	OTHER
1 NO. OF ACTIVITIES REQUESTED	62.00	31.00	1.00	30.00	0.
2 NO. OF ACTIVITIES STARTED	55.00	24.00	1.00	30.00	0.
3 NO. OF ACTIVITIES CANCELLED	0.	0.	0.	0.	0.
4 AVG. DELAY TO OBTAIN RESOURCE	.00	.00	.30	.00	0.

A I R C R A F T	TOTAL	TFX	OTHER
3 NUMBER OF AIRCRAFT AUTH.(EOP)	24.00	24.00	0.
4 NUMBER OF AIRCRAFT-DAYS AVAIL	720.00	720.00	0.
5 PCT SORTIES(INCL ALERT)	0.	0.	0.
6 PCT UNSCHED MAINTENANCE	98.25	98.25	0.
7 PCT SCHED MAINTENANCE	0.	0.	0.
8 PCT NORS	.01	.01	0.
9 PCT MISSION WAIT STATUS	0.	0.	0.
PCT SERVICE + WAITING	0.	0.	0.
1 PCT OPERATIONALLY READY	1.74	1.74	0.
AVG. AC POST SORTIE TIME(HRS)	0.	0.	0.
AVG. NO. OF SORTIES/ A/C /DAY	0.	0.	0.
FLYING HOURS	0.	0.	0.
7 NUMBER OF FCF TASKS FLOWN	0.	0.	0.
AVG. AC PRESORTIE TIME(HRS)	0.	0.	0.

RUN NUMBER ALPHA

P E R F O R M A N C E   S U M M A R Y

PERIOD FROM 0. TO 30.0   LEVEL 2

P E R S O N N E L	TOTAL	431F1	462X0	PILOT	461S0	461S5	461C0	461CS	OTHER
27 MANHOURS AVAILABLE (100)	10080.00	1440.00	1440.00	1440.00	1440.00	1440.00	1440.00	1440.00	0.
28 PERCENT UTILIZATION	4.82	4.13	2.61	8.70	1.06	2.00	4.82	10.41	0.
29 MANHOURS USED (100)	485.63	59.44	37.53	125.25	15.28	28.80	69.43	149.90	0.
30 PCT UNSCHED MAINT. OF STA	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	0.
31 PCT SCHED MAINT. OF STA	0.	0.	0.	0.	0.	0.	0.	0.	0.
P1 PCT PRIME OF STAT 29	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	0.
P2 PCT SUBSTITUTE OF STAT 29	0.	0.	0.	0.	0.	0.	0.	0.	0.
33 NUMBER OF MEN DEMANDED	37936.00	3516.00	7210.00	717.00	1737.00	2895.00	8189.00	13672.00	0.
P3 NUM OF MEN DEMANDED POST SCAN	37936.00	3516.00	7210.00	717.00	1737.00	2895.00	8189.00	13672.00	0.
34 % AVAIL BY ON. BAL. OF RES	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	0.
35 % AVAIL BY GEN SUBS OF RES	0.	0.	0.	0.	0.	0.	0.	0.	0.
36 % AVAIL BY EXPEDITE PROC.	0.	0.	0.	0.	0.	0.	0.	0.	0.
37 % AVAIL BY PREEMPTION PROC.	0.	0.	0.	0.	0.	0.	0.	0.	0.
38 % DEMANDS NOT AVAIL FOR RES	0.	0.	0.	0.	0.	0.	0.	0.	0.
39 OVERTIME MANHOURS USED (100)	0.	0.	0.	0.	0.	0.	0.	0.	0.
40 SIMULATED MH PER FLYING HOUR	0.	0.	0.	0.	0.	0.	0.	0.	0.

S U P P L Y	TOTAL	OTHER	M82A1	M82B1	M82C1	M82D1	M82E1	M82A2	M82B2	M82C2	M82D2
54 TOT DOLLAR INVEST.(1000)(EOP)	418093.01	0.	0.	240.00	0.	0.	0.	0.	0.	0.	0.
55 FILL RATE PERCENT	99.99	0.	99.51	100.00	0.	0.	0.	0.	0.	0.	0.
56 NUMBER OF BACKORDER-DAYS	.32	0.	.29	0.	0.	0.	0.	0.	0.	0.	0.
57 NUMBER OF UNITS DEMANDED	62992.00	0.	1430.00	12.00	0.	0.	0.	0.	0.	0.	0.
58 PCT OFF-THE-SHELF	99.99	0.	99.51	100.00	0.	0.	0.	0.	0.	0.	0.
59 PCT EXPEDITED REPAIR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
60 PCT PREEMPTION	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
61 PCT DEMANDS NOT SATIS.	.01	0.	.49	0.	0.	0.	0.	0.	0.	0.	0.
62 NUMBER OF CANNIBALIZATIONS	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
63 NO. ITEMS ON BACKORDER (EOP)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

S U P P L Y	TOTAL	M82E2	M82A3	M82B3	M82C3	M82D3	M82E3	MK82	BLDA1	BLDA2	BLDA3
54 TOT DOLLAR INVEST.(1000)(EOP)	418093.01	0.	0.	0.	0.	0.	0.	120.00	18973.01	19980.00	19980.00
55 FILL RATE PERCENT	99.99	0.	0.	0.	0.	0.	0.	100.00	100.00	0.	0.
56 NUMBER OF BACKORDER-DAYS	.32	0.	0.	0.	0.	0.	0.	.00	0.	0.	0.
57 NUMBER OF UNITS DEMANDED	62992.00	0.	0.	0.	0.	0.	0.	16745.00	5365.00	0.	0.
58 PCT OFF-THE-SHELF	99.99	0.	0.	0.	0.	0.	0.	100.00	100.00	0.	0.
59 PCT EXPEDITED REPAIR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
60 PCT PREEMPTION	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
61 PCT DEMANDS NOT SATIS.	.01	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
62 NUMBER OF CANNIBALIZATIONS	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
63 NO. ITEMS ON BACKORDER (EOP)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

RUN NUMBER ALPHA

PERFORMANCE SUMMARY

PERIOD FROM 0. TO 30.0 LEVEL 2

SUPPLY	TOTAL	BLDA4	BLDA5	PMKB2	82FIN	82BST	82FUS	20MB1	20MB1	20MM	BLDB1
4 TOT DOLLAR INVEST.(1000)(EOP)	418093.01	19980.00	19980.00	19980.00	19980.00	19980.00	19980.00	240.00	0.	240.00	19980.00
5 FILL RATE PERCENT	99.99	0.	0.	100.00	100.00	100.00	100.00	99.73	0.	100.00	100.00
6 NUMBER OF BACKORDER-DAYS	.32	0.	0.	0.	0.	0.	0.	.02	0.	0.	0.
7 NUMBER OF UNITS DEMANDED	62992.00	0.	0.	185.00	120.00	37.00	82.00	370.00	0.	9022.00	756.00
8 PCT OFF-THE-SHELF	99.99	0.	0.	100.00	100.00	100.00	100.00	99.73	0.	100.00	100.00
9 PCT EXPEDITED REPAIR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
10 PCT PREEMPTION	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
11 PCT DEMANDS NOT SATIS.	.01	0.	0.	0.	0.	0.	0.	27	0.	0.	0.
12 NUMBER OF CANNIBALIZATIONS	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
13 NO. ITEMS ON BACKORDER (EOP)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

SUPPLY	TOTAL	BLDB2	BLDB3	BLDB4	P20MM	AIM7C	AIM9E	AIP9	BLDC1	PAIM9	HOLDA
4 TOT DOLLAR INVEST.(1000)(EOP)	418093.01	19980.00	19980.00	19980.00	19980.00	0.	120.00	120.00	19980.00	19980.00	19980.00
5 FILL RATE PERCENT	99.99	0.	0.	0.	100.00	0.	99.86	100.00	100.00	100.00	100.00
NUMBER OF BACKORDER-DAYS	.32	0.	0.	0.	0.	0.	.01	0.	0.	0.	0.
NUMBER OF UNITS DEMANDED	62992.00	0.	0.	0.	27.00	0.	721.00	18025.00	744.00	124.00	5772.00
PCT OFF-THE-SHELF	99.99	0.	0.	0.	100.00	0.	99.86	100.00	100.00	100.00	100.00
PCT EXPEDITED REPAIR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
PCT PREEMPTION	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
PCT DEMANDS NOT SATIS.	.01	0.	0.	0.	0.	0.	14	0.	0.	0.	0.
52 NUMBER OF CANNIBALIZATIONS	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
53 NO. ITEMS ON BACKORDER (EOP)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

SUPPLY	TOTAL	HOLDB	HOLDC	HOLDD	HOLDE	OTHER
54 TOT DOLLAR INVEST.(1000)(EOP)	418093.01	19020.00	19980.00	19500.00	19860.00	0.
55 FILL RATE PERCENT	99.99	0.	0.	100.00	100.00	0.
56 NUMBER OF BACKORDER-DAYS	.32	0.	0.	0.	0.	0.
57 NUMBER OF UNITS DEMANDED	62992.00	0.	0.	728.00	727.00	0.
58 PCT OFF-THE-SHELF	99.99	0.	0.	100.00	100.00	0.
59 PCT EXPEDITED REPAIR	0.	0.	0.	0.	0.	0.
60 PCT PREEMPTION	0.	0.	0.	0.	0.	0.
61 PCT DEMANDS NOT SATIS.	.01	0.	0.	0.	0.	0.
62 NUMBER OF CANNIBALIZATIONS	0.	0.	0.	0.	0.	0.
63 NO. ITEMS ON BACKORDER (EOP)	0.	0.	0.	0.	0.	0.

RUN NUMBER ALPHA   P E R F O R M A N C E   S U M M A R Y   PERIOD FROM 30.0 TO 35.0   LEVEL 1

P E R S O N N E L	TOTAL	431F1	462X0	PILOT	461S0	461S5	461C0	461C5	OTHER
27 MANHOURS AVAILABLE (100)	1680.00	240.00	240.00	240.00	240.00	240.00	240.00	240.00	r.
28 PERCENT UTILIZATION	2.00	2.59	1.12	4.58	.23	.43	1.62	3.41	0.
29 MANHOURS USED (100)	33.58	6.23	2.69	11.00	.55	1.04	3.89	8.19	0.
30 PCT UNSCHED MAINT. OF STAT 29	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	0.
31 PCT SCHED MAINT. OF STAT 29	0.	0.	0.	0.	0.	0.	0.	0.	0.
P1 PCT PRIME OF STAT 29	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	0.
P2 PCT SUBSTITUTE OF STAT 29	0.	0.	0.	0.	0.	0.	0.	0.	0.
33 NUMBER OF MEN DEMANDED	2522.00	358.00	544.00	53.00	60.00	100.00	553.00	854.00	0.
P3 NBR OF MEN DEMANDED POST SCAN	2522.0C	358.00	544.00	53.00	60.00	100.00	553.00	854.00	0.
34 % AVAIL BY ON. BAL. OF RES	100.00	100.00	10[illegible]	100.00	100.00	100.00	100.00	100.00	0.
35 % AVAIL BY GEN SUBS OF RES	0.	0.	[illegible]	0.	0.	0.	0.	0.	0.
36 % AVAIL BY EXPEDITE PROC.	0.	0.	0.	0.	0.	0.	0.	0.	0.
37 % AVAIL BY PREEMPTION PRCC.	0.	0.	0.	0.	0.	0.	0.	0.	0.
38 % DEMANDS NOT AVAIL FOR RES	0.	0.	0.	0.	0.	0.	0.	0.	0.
39 OVERTIME MANHOURS USED (100)	0.	0.	0.	0.	0.	0.	0.	0.	0.
40 SIMULATED MH PER FLYING HOUR	0.	0.	0.	0.	0.	0.	0.	0.	

S U P P L Y	TOTAL	OTHER	MB2A1	MB231	MB2C1	MB2D1	MB2E1	MB2A2	MB2B2	MB2C2	MB2D2
54 TOT DOLLAR INVEST.(1000)(EOP)	418093.01	0.	0.	240.00	0.	0.	0.	0.	0.	0.	0.
55 FILL RATE PERCENT	95.25	0.	67.12	0.	0.	0.	0.	0.	0.	0.	0.
56 NUMBER OF BACKORDER-DAYS	278.61	0.	112.36	0.	0.	0.	0.	0.	0.	0.	0.
57 NUMBER OF UNITS DEMANDED	2567.00	0.	146.00	0.	0.	0.	0.	0.	0.	0.	0.
58 PCT OFF-THE-SHELF	95.25	0.	67.12	0.	0.	0.	0.	0.	0.	0.	0.
59 PCT EXPEDITED REPAIR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
60 PCT PREEMPTION	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
61 PCT DEMANDS NOT SATIS.	4.75	0.	32.88	0.	0.	0.	0.	0.	0.	0.	0.
62 NUMBER OF CANNIBALIZATIONS	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
63 NO. ITEMS ON BACKORDER (EOP)	122.00	0.	48.00	0.	0.	0.	0.	0.	0.	0.	0.

S U P P L Y	TOTAL	MB2E2	MB2A3	MB2B3	MB2C3	MB2D3	MB2E3	MK82	BLDA1	BLDA2	BLDA3
54 TOT DOLLAR INVEST.(1000)(EOP)	418093.01	0.	0.	0.	0.	0.	0.	120.00	18973.01	19980.00	19980.00
55 FILL RATE PERCENT	95.25	0.	0.	0.	0.	0.	0.	96.30	100.00	0.	0.
56 NUMBER OF BACKORDER-DAYS	278.61	0.	0.	0.	0.	0.	0.	56.18	0.	0.	0.
57 NUMBER OF UNITS DEMANDED	2567.00	0.	0.	0.	0.	0.	0.	649.00	174.00	0.	0.
58 PCT OFF-THE-SHELF	95.25	0.	0.	0.	0.	0.	0.	96.30	100.00	0.	0.
59 PCT EXPEDITED REPAIR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
60 PCT PREEMPTION	0.	0.	0.	0.	0.	0.	0.	3.70	0.	0.	0.
61 PCT DEMANDS NOT SATIS.	4.75	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
62 NUMBER OF CANNIBALIZATIONS	0.	0.	0.	0.	0.	0.	0.	24.00	0.	0.	0.
63 NO. ITEMS ON BACKORDER (EOP)	122.00	0.	0.	0.	0.						

RUN NUMBER ALPHA

P E R F O R M A N C E   S U M M A R Y

PERIOD FROM 30.0 TO 35.0   LEVEL 1

	S U P P L Y	TOTAL	BLDA4	BLDA5	PMK82	82FIN	82BST	82FUS	20MD1	20MB1	20MM	BLDB1
.4	TOT DOLLAR INVEST.(1000)(EOP)	418093.01	19980.00	19980.00	19980.00	19980.00	19980.00	19980.00	240.00	0.	240.00	19980.00
.5	FILL RATE PERCENT	95.25	0.	0.	100.00	100.00	100.00	100.00	87.18	0.	98.47	100.00
.6	NUMBER OF BACKORDER-DAYS	278.61	0.	0.	0.	0.	0.	C.	10.02	0.	10.02	0.
.7	NUMBER OF UNITS DEMANDED	2567.00	0.	0.	6.00	4.00	1.00	5.00	39.00	0.	327.00	28.00
.8	PCT OFF-THE-SHELF	95.25	0.	0.	100.00	100.00	100.00	100.00	87.18	0.	98.47	100.00
.9	PCT EXPEDITED REPAIR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
.C	PCT PREEMPTION	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
.1	PCT DEMANDS NOT SATIS.	4.75	0.	0.	0.	0.	0.	0.	12.82	0.	1.53	0.
.2	NUMBER OF CANNIBALIZATIONS	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
.3	NO. ITEMS ON BACKORDER (EOP)	122.00	0.	0.	0.	0.	0.	0.	5.0C	0.	5.00	0.

	S U P P L Y	TOTAL	BLDB2	BLDB3	BLD34	P20MM	AIM9C	AIM9E	AIM9	BLDC1	PAIK9	HOLDA
54	TOT DOLLAR INVEST.(1000)(EOP)	418093.01	19980.00	19980.00	19980.00	19980.00	0.	120.00	120.00	19980.00	19980.00	19980.00
55	FILL RATE PERCENT	95.25	0.	0.	0.	100.00	0.	72.60	96.92	100.00	100.00	100.00
56	NUMBER OF BACKORDER-DAYS	278.61	0.	0.	0.	0.	0.	45.02	45.02	0.	0.	0.
57	NUMBER OF UNITS DEMANDED	2567.00	0.	0.	0.	1.00	0.	73.00	649.00	24.00	4.00	340.00
58	PCT OFF-THE-SHELF	95.25	0.	0.	0.	100.00	0.	72.60	96.92	100.00	100.00	100.00
59	PCT EXPEDITED REPAIR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
60	PCT PREEMPTION	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
51	PCT DEMANDS NOT SATIS.	4.75	0.	0.	0.	0.	0.	27.40	3.08	0.	0.	0.
52	NUMBER OF CANNIBALIZATIONS	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
53	NO. ITEMS ON BACKORDER (EOP)	122.00	0.	0.	0.	0.	0.	20.00	20.00	0.	0.	0.

	S U P P L Y	TOTAL	HOLDB	HOLDC	HOLDD	HOLDE	OTHER
54	TOT DOLLAR INVEST.(1000)(EOP)	418093.01	19020.00	19980.00	19500.00	19860.00	0.
55	FILL RATE PERCENT	95.25	0.	0.	100.00	100.00	0.
56	NUMBER OF BACKORDER-DAYS	278.61	0.	0.	0.	0.	0.
57	NUMBER OF UNITS DEMANDED	2567.00	0.	0.	56.00	41.00	0.
58	PCT OFF-THE-SHELF	95.25	0.	0.	100.00	100.00	0.
59	PCT EXPEDITED REPAIR	0.	0.	0.	0.	0.	0.
60	PCT PREEMPTION	0.	0.	0.	0.	0.	0.
61	PCT DEMANDS NOT SATIS.	4.75	0.	0.	0.	0.	0.
62	NUMBER OF CANNIBALIZATIONS	0.	0.	0.	0.	0.	0.
63	NO. ITEMS ON BACKORDER (EOP)	122.00	0.	0.	0.	0.	0.

RUN NUMBER ALPHA   R E S O U R C E   D A T A (ITEM)   SIMULATION TIME = 15.000000

RES. NUMBER	REPORT COLUMN	RES. TYPE	NO. OF SUBST.	RES COST	AUTH QUAN	ON HAND BAL.	DUE IN BAL.	DUE OUT BAL.	NO. OF DEMANDS	CUTIL. FACTOR	UTIL. OR USNP.	LAST TIME OF UPDATE
1	1	AIRCRAFT	0	15000.0	24	0	31	7	31	-105.0	0.	0	15.0
2	1	MAN	0	10000.0	200	191	9	0	0	0.	.0	1	0.
3	2	MAN	0	10000.0	200	200	0	0	0	0.	.0	2	0.
4	3	MAN	0	10000.0	200	182	18	0	0	0.	.0	3	0.
5	4	MAN	0	10000.0	200	199	1	0	0	0.	.0	4	0.
6	5	MAN	1	10000.0	200	198	2	0	0	0.	.0	5	0.
7	6	MAN	0	10000.0	200	191	9	0	0	0.	.0	6	0.
8	7	MAN	1	10000.0	200	184	16	0	0	0.	.0	7	0.
9	2	PART	0	20000.0	0	18	0	0	704	256.7	0.	0	15.0
10	3	PART	0	20000.0	12	0	0	0	12	2.4	0.	0	15.0
11	4	PART	0	20000.0	0	0	0	0	0	0.	0.	0	15.0
12	5	PART	0	20000.0	0	0	0	0	0	0.	0.	0	15.0
13	6	PART	0	20000.0	0	0	0	0	0	0.	0.	0	15.0
14	7	PART	0	20000.0	0	0	0	0	0	0.	0.	0	15.0
15	8	PART	0	20000.0	0	0	0	0	0	0.	0.	0	15.0
16	9	PART	0	20000.0	0	0	0	0	0	0.	0.	0	15.0
17	10	PART	0	20000.0	0	0	0	0	0	0.	0.	0	15.0
18	11	PART	0	20000.0	0	0	0	0	0	0.	0.	0	15.0
19	12	PART	0	20000.0	0	0	0	0	0	0.	0.	0	15.0
20	13	PART	0	20000.0	0	0	0	0	0	0.	0.	0	15.0
21	14	PART	0	20000.0	0	0	0	0	0	0.	0.	0	15.0
22	15	PART	0	20000.0	0	0	0	0	0	0.	0.	0	15.0
23	16	PART	0	20000.0	0	0	0	0	0	0.	0.	0	15.0
24	17	PART	0	20000.0	6	24	0	0	9310	377.3	0.	0	15.0
25	18	PART	0	18992.0	999	941	0	0	2726	14106.2	0.	0	15.0
26	19	PART	0	20000.0	999	999	0	0	0	14985.0	0.	0	15.0
27	20	PART	0	20000.0	999	999	0	0	0	14985.0	0.	0	15.0
28	21	PART	0	20000.0	999	999	0	0	0	14985.0	0.	0	15.0
29	22	PART	0	20000.0	999	999	0	0	0	14985.0	0.	0	15.0
30	23	PART	0	20000.0	999	905	0	0	94	14245.7	0.	0	15.0
31	24	PART	0	20000.0	999	934	0	0	65	14442.9	0.	0	15.0
32	25	PART	0	20000.0	999	979	0	0	20	14809.5	0.	0	15.0
33	26	PART	0	20000.0	999	955	0	0	44	14639.3	0.	0	15.0
34	27	PART	0	20000.0	12	4	0	0	190	118.2	0.	0	15.0
35	28	PART	0	20000.0	0	0	0	0	0	0.	0.	0	15.0
36	29	PART	0	20000.0	12	13	0	0	4486	282.6	0.	0	15.0
37	30	PART	0	20000.0	999	971	0	0	392	14737.8	0.	0	15.0
38	31	PART	0	20000.0	999	999	0	0	0	14985.0	0.	0	15.0
39	32	PART	0	20000.0	999	999	0	0	0	14965.0	0.	0	15.0
40	33	PART	0	20000.0	999	999	0	0	0	14985.0	0.	0	15.0
41	34	PART	0	20000.0	999	985	0	0	14	14877.9	0.	0	15.0
42	35	PART	0	20000.0	0	0	0	0	0	0.	0.	0	15.0
43	36	PART	0	20000.0	6	12	2	0	358	196.7	0.	0	15.0
44	37	PART	0	20000.0	6	26	0	0	8950	395.4	0.	0	15.0
45	38	PART	0	20000.0	999	993	0	0	378	14892.3	0.	0	15.0
46	39	PART	0	20000.0	999	936	0	0	63	14489.1	0.	0	15.0
47	40	PART	0	20000.0	999	927	0	0	2888	13886.3	0.	0	15.0
48	41	PART	0	20000.0	951	999	0	0	0	14974.7	0.	0	15.0
49	42	PART	0	20000.0	999	999	0	0	0	14985.0	0.	0	15.0

50	43	PART	0	20000.0	975	991	0	0	364	14739.4	0.	0	15.0
51	44	PART	0	20000.0	993	985	0	0	366	14779.1	0.	0	15.0
52	1	AGE	2	20000.0	999	999	0	0	1087	14971.2	0.	0	15.0
53	2	AGE	0	20000.0	999	999	0	0	156	14970.5	0.	0	15.0
54	3	AGE	0	20000.0	999	998	0	0	151	14966.4	0.	0	15.0
55	4	AGE	0	20000.0	999	996	0	0	195	14960.2	0.	0	15.0
56	5	AGE	0	20000.0	999	999	0	0	106	14976.9	0.	0	15.0
57	6	AGE	2	20000.0	999	999	0	0	300	14969.9	0.	0	15.0
58	7	AGE	2	20000.0	999	999	0	0	0	14985.0	0.	0	15.0
59	8	AGE	2	20000.0	999	999	0	0	1	14985.0	0.	0	15.0
60	9	AGE	3	20000.0	999	996	3	0	826	14946.9	0.	0	15.0
61	11	AGE	2	20000.0	999	997	2	0	499	14961.1	0.	0	15.0
62	12	AGE	2	20000.0	999	999	0	0	4	14984.8	0.	0	15.0
63	13	AGE	2	20000.0	999	999	0	0	4	14984.9	0.	0	15.0
64	10	AGE	0	20000.0	999	999	0	0	6	14984.7	0.	0	15.0
65	14	AGE	1	20000.0	999	997	2	0	1103	14971.0	0.	0	15.0
66	21	AGE	0	20000.0	999	999	0	0	0	14985.0	0.	0	15.0
67	15	AGE	0	20000.0	999	999	0	0	4	14984.8	0.	0	15.0
68	16	AGE	0	28992.0	999	991	0	0	1274	14734.8	0.	0	15.0
69	17	AGE	0	20000.0	999	999	0	0	2	14984.9	0.	0	15.0
70	18	AGE	0	20000.0	999	999	0	0	2	14984.9	0.	0	15.0
71	19	AGE	0	20000.0	999	999	0	0	1	14985.0	0.	0	15.0
72	20	AGE	0	20000.0	999	999	0	0	15	14985.0	0.	0	15.0
73	45	OTHER	0	1.0	9999	12337	7	0	0	0.	0.	0	0.

RUN NUMBER ALPHA

RESOURCE DATA (ITEM)

SIMULATION TIME = 30.000000

RES. NUMBER	REPORT COLUMN	RES. TYPE	NO. OF SUBST.	RES. COST	AUTH QUAN	ON HAND	DUE IN BAL.	DUE OUT BAL.	NO. OF DEMANDS	CUTIL. FACTOR	UTIL.	OR USMP.	LAST TIME OF UPDATE
1	1	AIRCRAFT	0	15000.0	24	2	31	7	31	-210.0	0.	0	30.0
2	1	MAN	0	10000.0	---	197	3	0	0	0.	.0	1	0.
3	2	MAN	0	10000.0	200	164	16	0	0	0.	.0	2	0.
4	3	MAN	C	10000.0	200	182	18	0	0	0.	.0	3	0.
5	4	MAN	C	10000.0	200	197	3	0	0	0.	.0	4	0.
6	5	MAN	1	10000.0	200	195	5	0	0	0.	.0	5	0.
7	6	MAN	0	10000.0	200	190	10	0	0	0.	.0	6	0.
8	7	MAN	1	10000.0	200	180	20	0	0	0.	.0	7	0.
9	2	PART	0	20000.0	0	12	1	0	1430	522.8	0.	0	30.0
10	3	PART	0	20000.0	12	0	0	0	12	2.4	0.	0	30.0
11	4	PART	0	20000.0	0	0	0	0	0	0.	0.	0	30.0
12	5	PART	0	20000.0	0	0	0	0	0	0.	0.	0	30.0
13	6	PART	0	20000.0	0	0	0	0	0	0.	0.	0	30.0
14	7	PART	0	20000.0	0	0	0	0	0	0.	0.	0	30.0
15	8	PART	0	20000.0	0	0	0	0	0	0.	0.	0	30.0
16	9	PART	0	20000.0	0	0	0	0	0	0.	0.	0	30.0
17	10	PART	0	20000.0	0	0	0	0	0	0.	0.	0	30.0
18	11	PART	0	20000.0	0	0	0	0	0	0.	0.	0	30.0
19	12	PART	0	20000.0	0	0	0	0	0	0.	0.	0	30.0
20	13	PART	0	200C0.0	0	0	0	0	0	0.	0.	0	30.0
21	14	PART	0	20000.0	0	0	0	0	0	0.	0.	0	30.0
22	15	PART	0	20000.0	0	0	0	0	0	0.	0.	0	30.0
23	16	PART	0	20000.0	0	0	0	0	0	0.	0.	0	30.0
24	17	PART	0	20000.0	6	25	0	0	18745	755.9	0.	0	30.0
25	18	PART	0	18992.0	999	912	0	0	5365	28234.8	0.	0	30.0
26	19	PART	0	20000.0	999	999	0	0	0	29970.0	0.	0	30.0
27	20	PART	0	20000.0	999	999	0	0	0	29970.0	0.	0	30.0
28	21	PART	0	20000.0	999	999	0	0	0	29970.0	0.	0	30.0
29	22	PART	0	20000.0	999	999	0	0	0	29970.0	0.	0	30.0
30	23	PART	0	20000.0	999	814	0	0	185	27140.3	0.	0	30.0
31	24	PART	0	20000.0	999	879	0	0	120	28073.8	0.	0	30.0
32	25	PART	0	20000.0	999	962	0	0	37	29340.2	0.	0	30.0
33	26	PART	0	20000.0	999	917	0	0	82	28697.8	0.	0	30.0
34	27	PART	0	20000.0	12	6	0	0	370	227.2	0.	0	30.0
35	28	PART	0	20000.0	0	0	0	0	0	0.	0.	0	30.0
36	29	PART	0	20000.0	12	20	0	0	9022	551.2	0.	0	30.0
37	30	PART	0	20000.0	999	971	0	0	756	29489.5	0.	0	30.0
38	31	PART	0	20000.0	999	999	0	0	0	29970.0	0.	0	30.0
39	32	PART	0	20000.0	999	999	0	0	0	29970.0	0.	0	30.0
40	33	PART	0	20000.0	999	999	0	0	0	29970.0	0.	0	30.0
41	34	PART	0	20000.0	999	972	0	0	27	29558.4	0.	0	30.0
42	35	PART	0	20000.0	0	0	0	0	0	0.	0.	0	30.0
43	36	PART	0	20C00.0	6	11	1	0	721	405.2	0.	0	30.0
44	37	PART	0	20000.0	6	29	0	0	18025	794.7	0.	0	30.0
45	38	PART	0	20C00.0	999	987	0	0	744	29788.1	0.	0	30.0
46	39	PART	0	20000.0	999	875	0	0	124	28077.1	0.	0	30.0
47	40	PART	0	20000.0	999	947	0	0	5772	27734.7	0.	0	30.0
48	41	PART	0	20000.0	951	999	0	0	0	29959.7	0.	0	30.0
49	42	PART	0	20000.0	599	999	0	0	0	29970.0	0.	0	30.0

50	63	PART	0	20000.0	975	987	0	0	728	29497.1	0.	0	30.0
51	66	PART	0	20000.0	995	987	0	0	727	29526.7	0.	0	30.0
52	1	AGE	2	20000.0	999	998	1	0	2178	29942.2	0.	0	30.0
53	2	AGE	0	20000.0	999	998	0	0	306	29961.6	0.	0	30.0
54	3	AGE	0	20000.0	999	997	0	0	290	29934.1	0.	0	30.0
55	4	AGE	0	20000.0	999	997	0	0	383	29921.3	0.	0	30.0
56	5	AGE	0	20000.0	999	998	0	0	199	29955.0	0.	0	30.0
57	6	AGE	2	20000.0	999	998	1	0	583	29960.7	0.	0	30.0
58	7	AGE	2	20000.0	999	999	0	0	1	29970.0	0.	0	30.0
59	8	AGE	2	20000.0	999	999	0	0	3	29969.9	0.	0	30.0
60	9	AGE	3	20000.0	999	998	1	0	1643	29893.8	0.	0	30.0
61	11	AGE	2	20000.0	999	997	2	0	977	29923.2	0.	0	30.0
62	12	AGE	2	20000.0	999	999	0	0	7	29969.7	0.	0	30.0
63	13	AGE	2	20000.0	999	999	0	0	8	29969.7	0.	0	30.0
64	10	AGE	0	20000.0	999	999	0	0	13	29969.4	0.	0	30.0
65	14	AGE	1	20000.0	999	998	1	0	2197	29942.0	0.	0	30.0
66	21	AGE	0	20000.0	999	999	0	0	0	29970.0	0.	0	30.0
67	15	AGE	0	20000.0	999	999	0	0	7	29969.7	0.	0	30.0
68	16	AGE	0	28992.0	999	988	0	0	2541	29459.9	0.	0	30.0
69	17	AGE	0	20000.0	999	999	0	0	5	29969.8	0.	0	30.0
70	18	AGE	0	20000.0	999	999	0	0	5	29969.8	0.	0	30.0
71	19	AGE	0	20000.0	999	999	0	0	1	29970.0	0.	0	30.0
72	20	AGE	0	20000.0	999	999	0	0	30	29970.0	0.	0	30.0
73	65	OTHER	0	1.0	9999	14684	7	0	0	0.	0.	0	0.

RUN NUMBER ALPHA

R E S O U R C E   D A T A (ITEM)

SIMULATION TIME = 40.000000

RES. NUMBER	REPORT COLUMN	RES. TYPE	NO. OF SUBST.	RES COST	AUTH QUAN	ON HAND BAL.	DUE IN BAL.	DUE OUT BAL.	NO. OF DEMANDS	CUTIL. FACTOR	UTIL. OR	USNP.	LAST TIME OF UPDATE
1	1	AIRCRAFT	0	15000.0	24	0	31	7	31	-280.0	0.	0	40.0
2	1	MAN	0	10000.0	200	200	0	0	0	0.	.0	1	0.
3	2	MAN	0	10000.0	200	200	0	0	0	0.	.0	2	0.
4	3	MAN	0	10000.0	200	200	0	0	0	0.	.0	3	0.
5	4	MAN	0	10000.0	200	200	0	0	0	0.	.0	4	0.
6	5	MAN	1	10000.0	200	200	0	0	0	0.	.0	5	0.
7	6	MAN	0	10000.0	200	200	0	49	0	0.	.0	6	0.
8	7	MAN	1	10000.0	200	200	0	49	0	0.	.0	7	0.
9	2	PART	0	20000.0	0	0	0	48	1576	204.9	0.	0	40.0
10	3	PART	0	20000.0	12	0	0	0	12	2.4	0.	0	40.0
11	4	PART	0	20000.0	0	0	0	0	0	0.	0.	0	40.0
12	5	PART	0	20000.0	0	0	0	0	0	0.	0.	0	40.0
13	6	PART	0	20000.0	0	0	0	0	0	0.	0.	0	40.0
14	7	PART	0	20000.0	0	0	0	0	0	0.	0.	0	40.0
15	8	PART	0	20000.0	0	0	0	0	0	0.	0.	0	40.0
16	9	PART	0	20000.0	0	0	0	0	0	0.	0.	0	40.0
17	10	PART	0	20000.0	0	0	0	0	0	0.	0.	0	40.0
18	11	PART	0	20000.0	0	0	0	0	0	0.	0.	0	40.0
19	12	PART	0	20000.0	0	0	0	0	0	0.	0.	0	40.0
20	13	PART	0	20000.0	0	0	0	0	0	0.	0.	0	40.0
21	14	PART	0	20000.0	0	0	0	0	0	0.	0.	0	40.0
22	15	PART	0	20000.0	0	0	0	0	0	0.	0.	0	40.0
23	16	PART	0	20000.0	0	0	0	0	0	0.	0.	0	40.0
24	17	PART	0	20000.0	6	0	0	24	19394	621.0	0.	0	40.0
25	18	PART	0	18992.0	999	999	0	0	5539	38156.4	0.	0	40.0
26	19	PART	0	20000.0	999	999	0	0	0	39960.0	0.	0	40.0
27	20	PART	0	20000.0	999	999	0	0	0	39960.0	0.	0	40.0
28	21	PART	0	20000.0	999	999	0	0	0	39960.0	0.	0	40.0
29	22	PART	0	20000.0	959	999	0	0	0	39960.0	0.	0	40.0
30	23	PART	0	20000.0	999	808	0	0	191	35223.9	0.	0	40.0
31	24	PART	0	20000.0	999	875	0	0	124	36825.9	0.	0	40.0
32	25	PART	0	20000.0	999	961	0	0	38	38950.4	0.	0	40.0
33	26	PART	0	20000.0	999	912	0	0	87	37820.6	0.	0	40.0
34	27	PART	0	20000.0	12	0	0	5	409	213.5	0.	0	40.0
35	28	PART	0	20000.0	0	0	0	0	0	0.	0.	0	40.0
36	29	PART	0	20000.0	12	0	0	5	9349	557.3	0.	0	40.0
37	30	PART	0	20000.0	999	999	0	0	784	39452.4	0.	0	40.0
38	31	PART	0	20000.0	999	999	0	0	0	39960.0	0.	0	40.0
39	32	PART	0	20000.0	999	999	0	0	0	39960.0	0.	0	40.0
40	33	PART	0	20000.0	999	999	0	0	0	39960.0	0.	0	40.0
41	34	PART	0	20000.0	999	971	0	0	28	39269.4	0.	0	40.0
42	35	PART	0	20000.0	0	0	0	0	0	0.	0.	0	40.0
43	36	PART	0	20000.0	6	0	0	20	794	288.9	0.	0	40.0
44	37	PART	0	20000.0	6	0	0	20	18674	697.5	0.	0	40.0
45	38	PART	0	20000.0	999	999	0	0	768	39770.5	0.	0	40.0
46	39	PART	0	20000.0	999	871	0	0	128	36789.9	0.	0	40.0
47	40	PART	0	20000.0	999	999	0	0	6112	37577.9	0.	0	40.0
48	41	PART	0	20000.0	951	999	0	0	0	39949.7	0.	0	40.0
49	42	PART	0	20000.0	999	999	0	0	0	39960.0	0.	0	40.0

50	43	PART	0	20000.0	975	999	0	0	784	39443.0	0.	0	40.0
51	44	PART	0	20000.0	993	999	0	0	768	39506.7	0.	0	40.0
52	1	AGE	2	20000.0	999	999	0	24	2340	39754.2	0.	0	40.0
53	2	AGE	0	20000.0	999	999	0	0	320	39830.4	0.	0	40.0
54	3	AGE	0	20000.0	999	999	0	0	301	39922.8	0.	0	40.0
55	4	AGE	0	20000.0	999	999	0	0	396	39909.5	0.	0	40.0
56	5	AGE	0	20000.0	999	999	0	0	207	39944.4	0.	0	40.0
57	6	AGE	2	20000.0	999	999	0	0	603	39929.7	0.	0	40.0
58	7	AGE	2	20000.0	999	999	0	0	1	39960.0	0.	0	40.0
59	8	AGE	2	20000.0	999	999	0	0	4	39959.8	0.	0	40.0
60	9	AGE	3	20000.0	999	999	0	0	1739	39879.4	0.	0	40.0
61	11	AGE	2	20000.0	999	999	0	0	1029	39910.8	0.	0	40.0
62	12	AGE	2	20000.0	999	999	0	0	10	39959.6	0.	0	40.0
63	13	AGE	2	20000.0	939	999	0	0	10	39959.7	0.	0	40.0
64	10	AGE	0	20000.0	599	999	0	0	17	39959.2	0.	0	40.0
65	14	AGE	1	20000.0	999	999	0	25	2382	39749.9	0.	0	40.0
66	21	AGE	0	20000.0	999	999	0	0	0	39960.0	0.	0	40.0
67	15	AGE	0	20000.0	999	999	0	0	9	39959.6	0.	0	40.0
68	16	AGE	0	28992.0	999	1029	0	0	2694	39649.3	0.	0	40.0
69	17	AGE	0	20000.0	999	999	0	0	6	39959.7	0.	0	40.0
70	18	AGE	0	20000.0	999	999	0	0	6	39959.7	0.	0	40.0
71	19	AGE	0	20000.0	999	999	0	0	1	39960.0	0.	0	40.0
72	20	AGE	0	20000.0	999	999	0	0	30	39960.0	0.	0	40.0
73	45	OTHER	C	1.0	9999	15350	1	0	0	0.	0.	0	0.

First Constrained Simulation results

CNGFILE1
****

AS OF:
04/04/81

AUTH	1	24.0
AUTH	9	6.0
AUTH	10	6.0
AUTH	11	6.0
AUTH	12	0.0
AUTH	13	0.0
AUTH	14	0.0
AUTH	15	0.0
AUTH	16	0.0
AUTH	17	0.0
AUTH	18	0.0
AUTH	19	0.0
AUTH	20	0.0
AUTH	21	0.0
AUTH	22	0.0
AUTH	23	0.0
AUTH	24	18.0
AUTH	25	35.0
AUTH	26	35.0
AUTH	27	35.0
AUTH	28	35.0
AUTH	29	35.0
AUTH	34	10.0
AUTH	35	0.0
AUTH	36	10.0
AUTH	37	28.0
AUTH	38	0.0
AUTH	39	0.0
AUTH	40	0.0
AUTH	42	9.0
AUTH	43	9.0
AUTH	44	18.0
AUTH	45	24.0
AUTH	47	36.0
AUTH	48	48.0
AUTH	49	48.0
AUTH	50	48.0
AUTH	51	48.0
AUTH	52	17.0
AUTH	53	38.0
AUTH	54	38.0
AUTH	55	10.0
AUTH	56	10.0
AUTH	57	7.0
AUTH	58	7.0
AUTH	59	6.0
AUTH	60	10.0
AUTH	61	26.0
AUTH	62	26.0
AUTH	63	26.0
AUTH	65	30.0
AUTH	66	13.0

AUTH	67	30.0	
AUTH	68	28.0	
AUTH	69	28.0	
AUTH	70	28.0	
SAUTH	5	1.0	3
SAUTH	5	2.0	3
SAUTH	5	3.0	3
SAUTH	6	1.0	6
SAUTH	6	2.0	6
SAUTH	6	3.0	6
SAUTH	7	1.0	14
SAUTH	7	2.0	12
SAUTH	7	3.0	13
SAUTH	8	1.0	30
SAUTH	8	2.0	27
SAUTH	8	3.0	27

OFF EQUIPMENT BACK-ORDER MATRICES FOR RESOURCE 40150 (5)

PRIME RESOURCE REQUIREMENTS IN EXCESS OF ONHAND BALANCE

```
2219 15 6  3 3 1215 1917 1916 1411  911 1413 1210 1113 1621 2324 2426 2828 2829 2926 2624 2425 1616 1417 2323 2426 2624
+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
   1    2    3    4    5    6    7    8    9   10   11   12   13   14   15   16   17   18   19   20   21   22   23    0
```

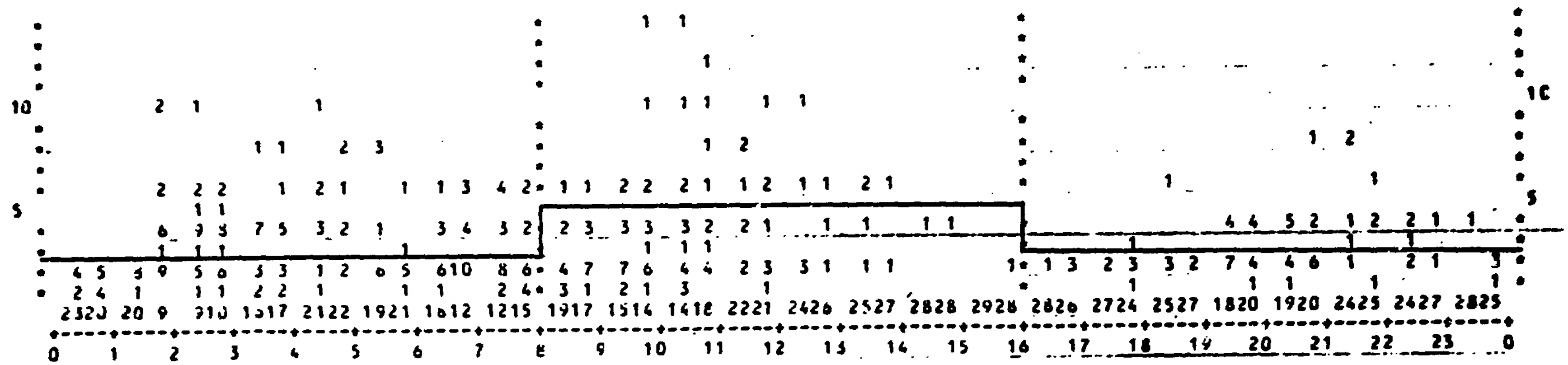
TASKS IN BACKORDER WITH 46150 AS A PRIME RESOURCE

```
2217 15 6  7 8 1215 1616 1717 1211  911 1415 12 9 1013 1621 2324 2426 2628 2727 2825 2624 2325 1314 1417 2323 2426 2624
+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
   1    2    3    4    5    5    7    8    9   10   11   12   13   14   15   16   17   18   19   20   21   22   23    0
```

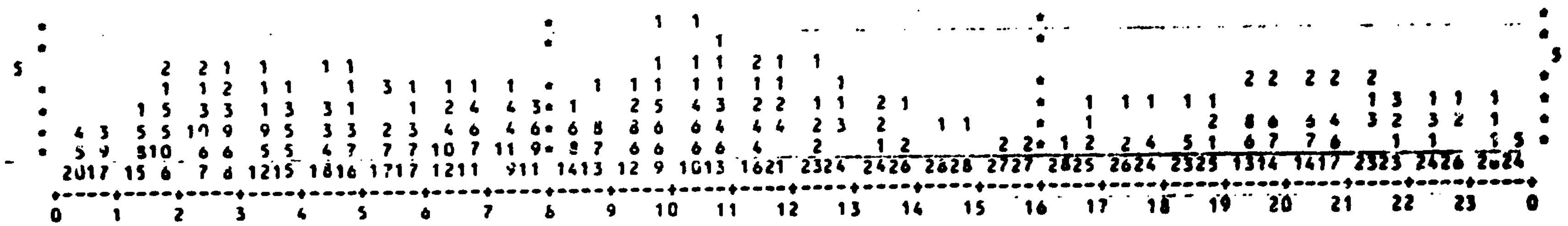
0 DATA IN SUBSTITUTE BACKORDER GRAPH

OFF EQUIPMENT BACK-ORDER MATRICES FOR RESOURCE 4615S (6)

PRIME RESOURCE REQUIREMENTS IN EXCESS OF ONHAND BALANCE



TASKS IN BACKORDER WITH 4615S AS A PRIME RESOURCE



NO DATA IN SUBSTITUTE BACKORDER GRAPH

RUN NUMBER ALPHA

P E R F O R M A N C E   S U M M A R Y   PERIOD FROM 0. TO 30.0   LEVEL 2

P E R S O N N E L	TOTAL	431F1	462X0	PILOT	461S0	461S5	461C0	461C5	OTHER
27 MANHOURS AVAILABLE (100)	4680.00	1440.00	1440.00	1440.00	21.60	43.20	93.60	201.60	0.
28 PERCENT UTILIZATION	10.25	4.11	2.59	8.66	68.61	64.65	73.76	72.82	0.
29 MANHOURS USED (100)	479.71	59.17	37.27	124.67	14.82	27.93	69.04	146.80	0.
30 PCT UNSCHED MAINT. OF STAT 29	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	0.
31 PCT SCHED MAINT. OF STAT 29	0.	0.	0.	0.	0.	0.	0.	0.	0.
P1 PCT PRIME OF STAT 29	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	0.
P2 PCT SUBSTITUTE OF STAT 29	0.	0.	0.	0.	0.	0.	0.	0.	0.
33 NUMBER OF MEN DEMANDED	37383.00	3493.00	7122.00	712.00	1689.00	2815.00	8078.00	13474.00	0.
P3 NUM OF MEN DEMANDED POST SCAN	37383.00	3493.00	7122.00	712.00	1689.00	2815.00	8080.00	13472.00	0.
34 % AVAIL BY ON. BAL. OF RES	95.73	100.00	100.00	100.00	84.07	82.81	93.82	97.44	0.
35 % AVAIL BY GEN SUBS OF RES	.07	0.	0.	0.	0.	0.	0.	.19	0.
36 % AVAIL BY EXPEDITE PROC.	.97	0.	0.	0.	0.	0.	3.51	.59	0.
37 % AVAIL BY PREEMPTION PROC.	.01	0.	0.	0.	0.	0.	.02	.01	0.
38 % DEMANDS NOT AVAIL FOR RES	3.22	0.	0.	0.	15.93	17.19	2.64	1.77	0.
39 OVERTIME MANHOURS USED (100)	.02	0.	0.	0.	0.	0.	.02	.01	0.
40 SIMULATED MH PER FLYING HOUR	0.	0.	0.	0.	0.	0.	0.	0.	0.

S H O P R E P A I R	TOTAL	OTHER	M82A1	M82B1	M82C1	M82D1	M82E1	M82A2	M82B2	M82C2	M82D2
44 NO. OF REPARABLE GENERATIONS	18134.00	0.	1384.00	47.00	0.	0.	0.	0.	0.	0.	0.
45 PCT BASE REPAIR	100.00	0.	100.00	100.00	0.	0.	0.	0.	0.	0.	0.
46 PCT DEPOT REPAIR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
47 AVERAGE BASE REPAIR CYCLE	.00	0.	.01	.01	0.	0.	0.	0.	0.	0.	0.
48 PCT ACTIVE REPAIR	100.00	0.	100.00	100.00	0.	0.	0.	0.	0.	0.	0.
49 PCT WHITE SPACE	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
50 NO. OF ITEMS IN REPAIR (EOP)	1.00	0.	1.00	0.	0.	0.	0.	0.	0.	0.	0.
51 NO. OF ITEMS BACKLOGGED (EOP)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

S H O P R E P A I R	TOTAL	M82E2	M82A3	M82B3	M82C3	M82D3	M82E3	MK82	BLDA1	BLDA2	BLDA3
44 NO. OF REPARABLE GENERATIONS	18134.00	0.	0.	0.	0.	0.	0.	728.00	1626.00	1682.00	1189.00
45 PCT BASE REPAIR	100.00	0.	0.	0.	0.	0.	0.	100.00	100.00	100.00	100.00
46 PCT DEPOT REPAIR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
47 AVERAGE BASE REPAIR CYCLE	.00	0.	0.	0.	0.	0.	0.	0.	.00	.00	0.
48 PCT ACTIVE REPAIR	100.00	0.	0.	0.	0.	0.	0.	0.	100.00	100.00	0.
49 PCT WHITE SPACE	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
50 NO. OF ITEMS IN REPAIR (EOP)	1.00	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
51 NO. OF ITEMS BACKLOGGED (EOP)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

S H O P R E P A I R	TOTAL	BLDA4	BLDA5	PMK82	82FIN	82UST	82FUS	20MD1	20MB1	20MM	BLDB1
44 NO. OF REPARABLE GENERATIONS	18134.00	493.00	87.00	0.	0.	0.	0.	360.00	0.	364.00	700.00
45 PCT BASE REPAIR	100.00	100.00	100.00	0.	0.	0.	0.	100.00	0.	100.00	100.00
46 PCT DEPOT REPAIR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
47 AVERAGE BASE REPAIR CYCLE	.00	0.	0.	0.	0.	0.	0.	.01	0.	0.	0.
48 PCT ACTIVE REPAIR	100.00	0.	0.	0.	0.	0.	0.	100.00	0.	0.	0.
49 PCT WHITE SPACE	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
50 NO. OF ITEMS IN REPAIR (EOP)	1.00	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
51 NO. OF ITEMS BACKLOGGED (EOP)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

RUN NUMBER ALPHA　　P E R F O R M A N C E　　S U M M A R Y　　PERIOD FROM 0. TO 30.0　　LEVEL 2

S H O P R E P A I R	TOTAL	BLDB2	BLDB3	BLDB4	P20MM	AIM9C	AIM9E	AIM9	BLDC1	PAIM9	HOLDA
44 NO. OF REPARABLE GENERATIONS	18134.00	0.	0.	0.	0.	0.	710.00	720.00	714.00	0.	5504.00
45 PCT BASE REPAIR	100.00	0.	0.	0.	0.	0.	100.00	100.00	100.00	0.	100.00
46 PCT DEPOT REPAIR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
47 AVERAGE BASE REPAIR CYCLE	.00	0.	0.	0.	0.	0.	.01	0.	0.	0.	.00
48 PCT ACTIVE REPAIR	100.00	0.	0.	0.	0.	0.	100.00	0.	0.	0.	100.00
49 PCT WHITE SPACE	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
50 NO. OF ITEMS IN REPAIR (EOP)	1.00	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
51 NO. OF ITEMS BACKLOGGED (EOP)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

S H O P R E P A I R	TOTAL	HOLDB	HOLDC	HOLDD	HOLDE	OTHER
44 NO. OF REPARABLE GENERATIONS	18134.00	168.00	26.00	722.00	710.00	0.
45 PCT BASE REPAIR	100.00	100.00	100.00	100.00	100.00	0.
46 PCT DEPOT REPAIR	0.	0.	0.	0.	0.	0.
47 AVERAGE BASE REPAIR CYCLE	.00	0.	0.	0.	0.	0.
48 PCT ACTIVE REPAIR	100.00	0.	0.	0.	0.	0.
49 PCT WHITE SPACE	0.	0.	0.	0.	0.	0.
50 NO. OF ITEMS IN REPAIR (EOP)	1.00	0.	0.	0.	0.	0.
51 NO. OF ITEMS BACKLOGGED (EOP)	0.	0.	0.	0.	0.	0.

S U P P L Y	TOTAL	OTHER	M82A1	M82B1	M82C1	M82D1	M82E1	M82A2	M82B2	M82C2	M82D2
54 TOT DOLLAR INVEST.(1000)(EOP)	130604.72	0.	120.00	120.00	120.00	0.	0.	0.	0.	0.	0.
55 FILL RATE PERCENT	99.51	0.	97.24	100.00	100.00	0.	0.	0.	0.	0.	0.
56 NUMBER OF BACKORDER-DAYS	490.81	0.	4.22	0.	0.	0.	0.	0.	0.	0.	0.
57 NUMBER OF UNITS DEMANDED	62231.00	0.	1378.00	42.00	6.00	0.	0.	0.	0.	0.	0.
58 PCT OFF-THE-SHELF	99.51	0.	97.24	100.00	100.00	0.	0.	0.	0.	0.	0.
59 PCT EXPEDITED REPAIR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
60 PCT PREEMPTION	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
61 PCT DEMANDS NOT SATIS.	.49	0.	2.76	0.	0.	0.	0.	0.	0.	0.	0.
62 NUMBER OF CANNIBALIZATIONS	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
63 NO. ITEMS ON BACKORDER (EOP)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

S U P P L Y	TOTAL	M82E2	M82A3	M82B3	M82C3	M82D3	M82E3	MK82	BLDA1	BLDA2	BLDA3
54 TOT DOLLAR INVEST.(1000)(EOP)	130604.72	0.	0.	0.	0.	0.	0.	180.00	664.72	700.00	700.00
55 FILL RATE PERCENT	99.51	0.	0.	0.	0.	0.	0.	100.00	88.84	100.00	100.00
56 NUMBER OF BACKORDER-DAYS	490.81	0.	0.	0.	0.	0.	0.	.00	451.13	0.	0.
57 NUMBER OF UNITS DEMANDED	62231.00	0.	0.	0.	0.	0.	0.	18545.00	1855.00	1682.00	1189.00
58 PCT OFF-THE-SHELF	99.51	0.	0.	0.	0.	0.	0.	100.00	88.84	100.00	100.00
59 PCT EXPEDITED REPAIR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
60 PCT PREEMPTION	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
61 PCT DEMANDS NOT SATIS.	.49	0.	0.	0.	0.	0.	0.	0.	11.16	0.	0.
62 NUMBER OF CANNIBALIZATIONS	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
63 NO. ITEMS ON BACKORDER (EOP)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

S U P P L Y	TOTAL	BLDA4	BLDA5	PMK82	82FLN	82BST	82FUS	20MD1	20MB1	20MM	BLDB1
54 TOT DOLLAR INVEST.(1000)(EOP)	130604.72	700.00	700.00	19980.00	19980.00	19980.00	19980.00	200.00	0.	200.00	560.00
55 FILL RATE PERCENT	99.51	100.00	100.00	100.00	100.00	100.00	100.00	98.89	0.	100.00	92.00
56 NUMBER OF BACKORDER-DAYS	490.81	0.	0.	0.	0.	0.	0.	.34	0.	.00	35.12
57 NUMBER OF UNITS DEMANDED	62231.00	493.00	87.00	182.00	107.00	45.00	84.00	361.00	0.	8917.00	700.00
58 PCT OFF-THE-SHELF	99.51	100.00	100.00	100.00	100.00	100.00	100.00	98.89	0.	100.00	92.00
59 PCT EXPEDITED REPAIR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
60 PCT PREEMPTION	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
61 PCT DEMANDS NOT SATIS.	.49	0.	0.	0.	0.	0.	0.	1.11	0.	0.	8.00
62 NUMBER OF CANNIBALIZATIONS	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
63 NO. ITEMS ON BACKORDER (EOP)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

S U P P L Y	TOTAL	BLDB2	BLDB3	BLDB4	P20MM	AIM9C	AIM9E	AIM9	BLDC1	PAIM9	HOLDA
54 TOT DOLLAR INVEST.(1000)(EOP)	130604.72	0.	0.	0.	19980.00	180.00	180.00	360.00	480.00	19980.00	720.00
55 FILL RATE PERCENT	99.51	0.	0.	0.	100.00	100.00	100.00	100.00	100.00	100.00	100.00
56 NUMBER OF BACKORDER-DAYS	490.81	0.	0.	0.	0.	0.	0.	.00	0.	0.	0.
57 NUMBER OF UNITS DEMANDED	62231.00	0.	0.	0.	26.00	2.00	711.00	17825.00	720.00	120.00	5536.00
58 PCT OFF-THE-SHELF	99.51	0.	0.	0.	100.00	100.00	100.00	100.00	100.00	100.00	100.00
59 PCT EXPEDITED REPAIR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
60 PCT PREEMPTION	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
61 PCT DEMANDS NOT SATIS.	.49	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
62 NUMBER OF CANNIBALIZATIONS	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
63 NO. ITEMS ON BACKORDER (EOP)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

S U P P L Y	TOTAL	HOLDB	HOLDC	HOLDD	HOLDE	OTHER
54 TOT DOLLAR INVEST.(1000)(EOP)	130604.72	960.00	960.00	960.00	960.00	0.
55 FILL RATE PERCENT	99.51	100.00	0.	100.00	100.00	0.
56 NUMBER OF BACKORDER-DAYS	490.81	0.	0.	0.	0.	0.
57 NUMBER OF UNITS DEMANDED	62231.00	188.00	0.	720.00	710.00	0.
58 PCT OFF-THE-SHELF	99.51	100.00	0.	100.00	100.00	0.
59 PCT EXPEDITED REPAIR	0.	0.	0.	0.	0.	0.
60 PCT PREEMPTION	0.	0.	0.	0.	0.	0.
61 PCT DEMANDS NOT SATIS.	.49	0.	0.	0.	0.	0.
62 NUMBER OF CANNIBALIZATIONS	0.	0.	0.	0.	0.	0.
63 NO. ITEMS ON BACKORDER (EOP)	0.	0.	0.	0.	0.	0.

RUN NUMBER ALPHA   PERFORMANCE SUMMARY   PERIOD FROM 0. TO 30.0   LEVEL 2

	E Q U I P M E N T	TOTAL	M84	5TON	10TON	25FLB	40FLB	4FORKS	6FORKS	10FORS	M-11	JAMER
68	TOT DOLLAR INVEST.(1000)(EOP)	67751.78	340.00	760.00	760.00	200.00	200.00	140.00	140.00	120.00	200.00	19980.00
69	EQUIPMENT HOURS AUTH. (100)	24300.00	122.40	273.60	273.60	72.00	72.00	50.40	50.40	43.20	72.00	7192.80
70	EQUIPMENT HOURS AVAIL. (100)	24300.00	122.40	273.60	273.60	72.00	72.00	50.40	50.40	43.20	72.00	7192.80
71	PCT USED-UNSCHED MAINT	.26	5.40	1.20	1.33	7.15	2.30	13.51	.02	.07	25.16	.00
72	PCT USED-SCHED MAINT	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
73	PCT UNUSED	99.74	94.60	98.80	98.67	92.85	97.70	86.49	99.98	99.93	74.84	100.00
74	NUMBER OF BACKORDER-DAYS	1.35	0.	0.	0.	0.	0.	1.35	0.	0.	0.	0.
75	NUMBER OF UNITS DEMANDED	11206.00	2156.00	296.00	283.00	374.00	191.00	566.00	1.00	3.00	1630.00	13.00
76	PCT AVAILABLE	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
77	PCT PROV. BY EXPEDITE	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
78	PCT PROV. BY PREEMPTION	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
79	PCT DEMANDS NOT SATIS.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
80	EQUIP HOURS BACKLOG(100)(EOP)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

	E Q U I P M E N T	TOTAL	4FORKC	6FORKC	10FORKC	1HTON	2HTON	MHU12	MHU85	MHU11	CLOCK	TIMER
68	TOT DOLLAR INVEST.(1000)(EOP)	67751.78	520.00	520.00	520.00	600.00	600.00	811.78	560.00	560.00	19980.00	19980.00
69	EQUIPMENT HOURS AUTH. (100)	24300.00	187.20	187.20	187.20	216.00	216.00	201.60	201.60	201.60	7192.80	7192.80
70	EQUIPMENT HOURS AVAIL. (100)	24300.00	187.20	187.20	187.20	216.00	216.00	201.60	201.60	201.60	7192.80	7192.80
71	PCT USED-UNSCHED MAINT	.26	5.86	.04	.04	3.06	.03	.03	.03	.02	0.	0.
72	PCT USED-SCHED MAINT	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
73	PCT UNUSED	99.74	94.14	99.96	99.96	96.94	99.97	99.97	99.97	99.98	100.00	100.00
74	NUMBER OF BACKORDER-DAYS	1.35	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
75	NUMBER OF UNITS DEMANDED	11206.00	958.00	7.00	8.00	2159.00	7.00	2511.00	5.00	5.00	1.00	30.00
76	PCT AVAILABLE	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
77	PCT PROV. BY EXPEDITE	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
78	PCT PROV. BY PREEMPTION	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
79	PCT DEMANDS NOT SATIS.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
80	EQUIP HOURS BACKLOG(100)(EOP)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

	E Q U I P M E N T	TOTAL	3/4TON	OTHER
68	TOT DOLLAR INVEST.(1000)(EOP)	67751.78	260.00	0.
69	EQUIPMENT HOURS AUTH. (100)	24300.00	93.60	0.
70	EQUIPMENT HOURS AVAIL. (100)	24300.00	93.60	0.
71	PCT USED-UNSCHED MAINT	.26	0.	0.
72	PCT USED-SCHED MAINT	0.	0.	0.
73	PCT UNUSED	99.74	100.00	0.
74	NUMBER OF BACKORDER-DAYS	1.35	0.	0.
75	NUMBER OF UNITS DEMANDED	11206.00	0.	0.
76	PCT AVAILABLE	100.00	0.	0.
77	PCT PROV. BY EXPEDITE	0.	0.	0.
78	PCT PROV. BY PREEMPTION	0.	0.	0.
79	PCT DEMANDS NOT SATIS.	0.	0.	0.
80	EQUIP HOURS BACKLOG(100)(EOP)	0.	0.	0.

RES. NUMBER	REPORT COLUMN	RES. TYPE	NO. OF SUBST.	RES COST	AUTH QUAN	ON HAND BAL.	DUE IN BAL.	DUE OUT BAL.	NO. OF DEMANDS	CUTIL. FACTOR	UTIL. OR	USHP.	LAST TIME OF UPDATE
1	1	AIRCRAFT	0	15000.0	24	0	31	7	31	-210.0	0.	0	30.0
2	1	MAN	0	10000.0	200	190	10	0	0	0.	.0	1	0.
3	2	MAN	0	10000.0	200	200	0	0	0	0.	.0	2	0.
4	3	MAN	0	10000.0	200	183	17	0	0	0.	.0	3	0.
5	4	MAN	0	10000.0	3	3	0	0	0	0.	.0	4	0.
6	5	MAN	1	10000.0	6	6	0	0	0	0.	.0	5	0.
7	6	MAN	0	10000.0	14	2	12	0	0	0.	.0	6	0.
8	7	MAN	1	10000.0	50	5	25	0	0	0.	.0	7	0.
9	2	PART	0	20000.0	6	11	1	0	1578	185.1	0.	0	30.0
10	3	PART	0	20000.0	6	11	0	0	42	301.4	0.	0	30.0
11	4	PART	0	20000.0	6	0	0	0	6	2.4	0.	0	30.0
12	5	PART	0	20000.0	0	0	0	0	0	0.	0.	0	30.0
13	6	PART	0	20000.0	0	0	0	0	0	0.	0.	0	30.0
14	7	PART	0	20000.0	0	0	0	0	0	0.	0.	0	30.0
15	8	PART	0	20000.0	0	0	0	0	0	0.	0.	0	30.0
16	9	PART	0	20000.0	0	0	0	0	0	0.	0.	0	30.0
17	10	PART	0	20000.0	0	0	0	0	0	0.	0.	0	30.0
18	11	PART	0	20000.0	0	0	0	0	0	0.	0.	0	30.0
19	12	PART	0	20000.0	0	0	0	0	0	0.	0.	0	30.0
20	13	PART	0	20000.0	0	0	0	0	0	0.	0.	0	30.0
21	14	PART	0	20000.0	0	0	0	0	0	0.	0.	0	30.0
22	15	PART	0	20000.0	0	0	0	0	0	0.	0.	0	30.0
23	16	PART	0	20000.0	0	0	0	0	0	0.	0.	0	30.0
24	17	PART	0	20000.0	9	24	0	0	16545	766.3	0.	0	30.0
25	18	PART	0	18992.0	35	6	0	0	1855	-89.1	0.	0	30.0
26	19	PART	0	20000.0	35	35	0	0	1682	442.3	0.	0	30.0
27	20	PART	0	20000.0	35	35	0	0	1139	611.5	0.	0	30.0
28	21	PART	0	20000.0	35	35	0	0	493	841.8	0.	0	30.0
29	22	PART	0	20000.0	35	35	0	0	87	1004.4	0.	0	30.0
30	23	PART	0	20000.0	999	817	0	0	182	27131.4	0.	0	30.0
31	24	PART	0	20000.0	999	892	0	0	107	28327.2	0.	0	30.0
32	25	PART	0	20000.0	999	954	0	0	45	29258.2	0.	0	30.0
33	26	PART	0	20000.0	999	915	0	0	84	28563.3	0.	0	30.0
34	27	PART	0	20000.0	10	9	0	0	361	246.6	0.	0	30.0
35	28	PART	0	20000.0	0	0	0	0	0	0.	0.	0	30.0
36	29	PART	0	20000.0	10	13	0	0	8917	580.2	0.	0	30.0
37	30	PART	0	20000.0	28	28	0	0	700	326.6	0.	0	30.0
38	31	PART	0	20000.0	0	0	0	0	0	0.	0.	0	30.0
39	32	PART	0	20000.0	0	0	0	0	0	0.	0.	0	30.0
40	33	PART	0	20000.0	0	0	0	0	0	0.	0.	0	30.0
41	34	PART	0	20000.0	999	973	0	0	26	29576.7	0.	0	30.0
42	35	PART	0	20000.0	9	7	0	0	2	211.5	0.	0	30.0
43	36	PART	0	20000.0	9	8	0	0	711	191.5	0.	0	30.0
44	37	PART	0	20000.0	18	25	0	0	17825	807.1	0.	0	30.0
45	38	PART	0	20000.0	24	18	0	0	720	522.2	0.	0	30.0
46	39	PART	0	20000.0	999	879	0	0	120	28149.1	0.	0	30.0
47	40	PART	0	20000.0	36	4	0	0	5536	894.9	0.	0	30.0
48	41	PART	0	20000.0	48	28	0	0	188	950.1	0.	0	30.0
49	42	PART	0	20000.0	48	74	0	0	0	2208.7	0.	0	30.0

50	43	PART	0	20000.0	48	50	0	0	720	1526.5	0.	0	30.0
51	44	PART	0	20000.0	48	48	0	0	710	1500.3	0.	0	30.0
52	1	AGE	2	20000.0	17	15	2	0	2156	479.3	0.	0	30.0
53	2	AGE	0	20000.0	38	38	0	0	296	1101.4	0.	0	30.0
54	3	AGE	0	20000.0	34	[illegible]	0	0	283	1095.4	0.	0	30.0
55	4	AGE	0	20000.0	10	10	0	0	374	238.8	0.	0	30.0
56	5	AGE	0	20000.0	10	10	0	0	191	278.6	0.	0	30.0
57	6	AGE	2	20000.0	7	7	0	0	566	160.8	0.	0	30.0
58	7	AGE	2	20000.0	7	7	0	0	1	210.0	0.	0	30.0
59	8	AGE	2	20000.0	6	6	0	0	3	179.9	0.	0	30.0
60	9	AGE	3	20000.0	10	8	2	0	1650	223.8	0.	0	30.0
61	11	AGE	2	20000.0	26	25	1	0	958	734.1	0.	0	30.0
62	12	AGE	2	[illegible]0000.0	26	[illegible]	0	0	7	779.7	0.	0	30.0
63	13	AGE	2	[illegible]000.0	26	[illegible]	0	0	8	779.7	0.	0	30.0
64	10	AGE	0	[illegible]0000.0	999	999	0	0	13	29969.5	0.	0	30.0
65	14	AGE	1	20000.0	30	29	1	0	2159	870.9	0.	0	30.0
66	21	AGE	[illegible]	20000.0	13	13	0	0	0	390.0	0.	0	30.0
67	15	AGE	0	[illegible]000.0	30	30	0	0	7	899.7	0.	0	30.0
68	16	[illegible]	0	[illegible]92.0	28	19	0	0	2511	822.8	0.	0	30.0
69	17	[illegible]	0	[illegible]000.0	28	23	0	0	5	839.8	0.	0	30.0
70	18	[illegible]	C	20000.0	28	28	0	0	5	839.8	0.	0	30.0
71	19	AGE	0	20000.0	999	999	0	0	1	29970.0	0.	0	30.0
72	20	AGE	0	20000.0	999	999	0	0	30	29970.0	0.	0	30.0
73	45	OTHER	0	1.0	9999	14644	7	0	0	0.	0.	0	0.

Second Constrained Simulation Results

AUTH	1	24.0
AUTH	9	6.0
AUTH	10	6.0
AUTH	11	6.0
AUTH	12	0.0
AUTH	13	0.0
AUTH	14	0.0
AUTH	15	0.0
AUTH	16	0.0
AUTH	17	0.0
AUTH	18	0.0
AUTH	19	0.0
AUTH	20	0.0
AUTH	21	0.0
AUTH	22	0.0
AUTH	23	0.0
AUTH	24	9.0
AUTH	25	58.0
AUTH	26	58.0
AUTH	27	29.0
AUTH	28	35.0
AUTH	29	35.0
AUTH	34	10.0
AUTH	35	0.0
AUTH	36	10.0
AUTH	37	28.0
AUTH	38	0.0
AUTH	39	0.0
AUTH	40	0.0
AUTH	42	9.0
AUTH	43	9.0
AUTH	44	18.0
AUTH	45	6.0
AUTH	47	8.0
AUTH	48	8.0
AUTH	49	8.0
AUTH	50	34.0
AUTH	51	32.0
AUTH	52	3.0
AUTH	53	2.0
AUTH	54	2.0
AUTH	55	3.0
AUTH	56	2.0
AUTH	57	2.0
AUTH	58	1.0
AUTH	59	1.0
AUTH	60	2.0
AUTH	61	1.0
AUTH	62	1.0
AUTH	63	2.0
AUTH	65	2.0
AUTH	66	1.0

AUTH	67	1.0	
AUTH	68	7.0	
AUTH	69	6.0	
AUTH	70	6.0	
SAUTH	5	1.0	5
SAUTH	5	2.0	5
SAUTH	5	3.0	5
SAUTH	6	1.0	8
SAUTH	6	2.0	10
SAUTH	6	3.0	8
SAUTH	7	1.0	14
SAUTH	7	2.0	12
SAUTH	7	3.0	13
SAUTH	8	1.0	30
SAUTH	8	2.0	27
SAUTH	8	3.0	27
TSUB1	32	0.0	33

AGR ... ALPHA   P E R F O R M A N C E   S U M M A R Y   PERIOD FROM 0. TO 30.0   LEVEL 2

P E R S O N N E L	TOTAL	451F1	462X0	PILOT	461S0	461S5	461C0	461C5	OTHER
27 MANHOURS AVAILABLE (100)	4713.60	1440.00	1440.00	1440.00	36.00	62.40	93.60	201.60	0.
28 PERCENT UTILIZATION	10.11	4.11	2.55	8.60	40.93	44.47	72.98	72.51	0.
29 MANHOURS USED (100)	476.60	59.20	36.05	123.79	14.73	27.75	68.31	146.18	0.
30 PCT UNSCHED MAINT. OF STAT 29	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	0.
31 PCT SCHED MAINT. OF STAT 29	0.	0.	0.	0.	0.	0.	0.	0.	0.
P1 PCT PRIME OF STAT 29	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	0.
P2 PCT SUBSTITUTE OF STAT 29	0.	0.	0.	0.	0.	0.	0.	0.	0.
33 NUMBER OF RES DEMANDED	37037.00	3474.00	7096.00	707.00	1666.00	2761.00	8006.00	13355.00	0.
P3 NO. OF RES DEMANDED POST SCAN	37067.00	3474.00	7096.00	707.00	1668.00	2761.00	8007.00	13354.00	0.
34 % AVAIL BY ON. BAL. OF RES	93.00	100.00	100.00	100.00	100.00	97.09	95.58	97.69	0.
35 % AVAIL BY GEN SUBS OF RES	.04	0.	0.	0.	0.	0.	0.	.12	0.
36 % AVAIL BY EXPEDITE PROC.	.44	0.	0.	0.	0.	0.	1.29	.46	0.
37 % AVAIL BY PREEMPTION PROC.	0.	0.	0.	0.	0.	0.	0.	0.	0.
38 % DEMANDS NOT AVAIL FOR RES	1.52	0.	0.	0.	0.	2.91	3.13	1.72	0.
39 OVERTIME MANHOURS USED (100)	.00	0.	0.	0.	0.	0.	.00	0.	0.
40 SIMULATED MH PER FLYING HOUR	0.	0.	0.	0.	0.	0.	0.	0.	0.

S H O P R E P A I R	TOTAL	OTHER	M82A1	M8231	M82C1	M8201	M82E1	M82A2	M8232	M82C2	M8202
44 NO. OF REPARABLE GENERATIONS	17992.00	0.	816.00	519.00	58.00	2.00	0.	6.00	1.00	7.00	2.00
45 PCT BASE REPAIR	100.00	0.	100.00	100.00	100.00	100.00	0.	100.00	100.00	100.00	100.00
46 PCT DEPOT REPAIR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
47 AVERAGE BASE REPAIR CYCLE	.00	0.	.01	.01	.01	.02	0.	.01	.02	.01	.01
48 PCT ACTIVE REPAIR	100.00	0.	100.00	100.00	100.00	100.00	0.	100.00	100.00	100.00	100.00
49 PCT WHITE SPACE	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
50 NO. OF ITEMS IN REPAIR (EOP)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
51 NO. OF ITEMS BACKLOGGED (EOP)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

S H O P R E P A I R	TOTAL	M82E2	M82A3	M8233	M82C3	M8203	M82E3	MK82	BLDA1	BLDA2	BLDA3
44 NO. OF REPARABLE GENERATIONS	17992.00	0.	6.00	0.	1.00	0.	0.	724.00	3508.00	1595.00	58.00
45 PCT BASE REPAIR	100.00	0.	100.00	0.	100.00	0.	0.	100.00	100.00	100.00	100.00
46 PCT DEPOT REPAIR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
47 AVERAGE BASE REPAIR CYCLE	.00	0.	.01	0.	.01	0.	0.	0.	.00	0.	0.
48 PCT ACTIVE REPAIR	100.00	0.	100.00	0.	100.00	0.	0.	0.	100.00	0.	0.
49 PCT WHITE SPACE	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
50 NO. OF ITEMS IN REPAIR (EOP)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
51 NO. OF ITEMS BACKLOGGED (EOP)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

S H O P R E P A I R	TOTAL	BLDA4	BLDA5	PNCB2	12EIN	82UST	82FUS	20MB1	20MB1	20MM	BLDB1
44 NO. OF REPARABLE GENERATIONS	17992.00	29.00	359.00	0.	0.	0.	0.	350.00	0.	304.00	672.00
45 PCT BASE REPAIR	100.00	100.00	100.00	0.	0.	0.	0.	100.00	0.	100.00	100.00
46 PCT DEPOT REPAIR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
47 AVERAGE BASE REPAIR CYCLE	.00	0.	0.	0.	0.	0.	0.	.01	0.	0.	0.
48 PCT ACTIVE REPAIR	100.00	0.	0.	0.	0.	0.	0.	100.00	0.	0.	0.
49 PCT WHITE SPACE	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
50 NO. OF ITEMS IN REPAIR (EOP)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
51 NO. OF ITEMS BACKLOGGED (EOP)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

ALPHA

PERFORMANCE SUMMARY — PERIOD FROM 0. TO 30.0 — LEVEL 2

SHOP REPAIR	TOTAL	ULDB2	ULDB3	ULB36	P2OMM	AIMYC	AIM9E	AIM9	BLDC1	PAIM9	HOLDA
44 NO. OF REPARABLE GENERATIONS	17992.00	0.	0.	0.	0.	0.	705.00	726.00	584.00	0.	5342.00
45 PCT BASE REPAIR	100.00	0.	0.	0.	0.	0.	100.00	100.00	100.00	0.	100.00
46 PCT DEPOT REPAIR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
47 AVERAGE BASE REPAIR CYCLE	.00	0.	0.	0.	0.	0.	.01	0.	0.	0.	.00
48 PCT ACTIVE REPAIR	100.00	0.	0.	0.	0.	0.	100.00	0.	0.	0.	100.00
49 PCT WHITE SPACE	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
50 NO. OF ITEMS IN REPAIR (EOP)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
51 NO. OF ITEMS BACKLOGGED (EOP)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

SHOP REPAIR	TOTAL	HOLDB	HOLDC	HOLDD	HOLDE	OTHER
44 NO. OF REPARABLE GENERATIONS	17992.00	2088.00	264.00	726.00	710.00	0.
45 PCT BASE REPAIR	100.00	100.00	100.00	100.00	100.00	0.
46 PCT DEPOT REPAIR	0.	0.	0.	0.	0.	0.
47 AVERAGE BASE REPAIR CYCLE	.00	.00	0.	0.	0.	0.
48 PCT ACTIVE REPAIR	100.00	100.00	0.	0.	0.	0.
49 PCT WHITE SPACE	0.	0.	0.	0.	0.	0.
50 NO. OF ITEMS IN REPAIR (EOP)	0.	0.	0.	0.	0.	0.
51 NO. OF ITEMS BACKLOGGED (EOP)	0.	0.	0.	0.	0.	0.

SUPPLY	TOTAL	OTHER	M82A1	M82B1	M82C1	M82D1	M82E1	M82A2	M82B2	M82C2	M82D2
54 TOT DOLLAR INVEST.(1000)(EOP)	122261.54	0.	120.00	120.00	120.00	0.	0.	0.	0.	0.	0.
55 FILL RATE PERCENT	99.37	0.	83.50	100.00	100.00	0.	0.	100.00	0.	100.00	100.00
56 NUMBER OF BACKORDER-DAYS	125.71	0.	11.00	0.	0.	0.	0.	0.	0.	0.	0.
57 NUMBER OF UNITS DEMANDED	61919.00	0.	624.00	522.00	60.00	0.	0.	4.00	0.	6.00	2.00
58 PCT OFF-THE-SHELF	99.37	0.	83.50	100.00	100.00	0.	0.	100.00	0.	100.00	100.00
59 PCT EXPEDITED REPAIR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
60 PCT PREEMPTION	0.	0.	3.	0.	0.	0.	0.	0.	0.	0.	0.
61 PCT DEMANDS NOT SATIS.	.63	0.	16.50	0.	0.	0.	0.	0.	0.	0.	0.
62 NUMBER OF CANNIBALIZATIONS	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
63 NO. ITEMS ON BACKORDER (EOP)	2.00	0.	2.00	0.	0.	0.	0.	0.	0.	0.	0.

SUPPLY	TOTAL	M82E2	M82A3	M82B3	M82C3	M82D3	M82E3	MK82	BLDA1	BLDA2	BLDA3
54 TOT DOLLAR INVEST.(1000)(EOP)	122261.54	0.	0.	0.	0.	0.	0.	180.00	1101.54	1160.00	580.00
55 FILL RATE PERCENT	99.37	0.	100.00	0.	0.	0.	0.	100.00	97.63	100.00	100.00
56 NUMBER OF BACKORDER-DAYS	125.71	0.	0.	0.	0.	0.	0.	.00	60.80	0.	0.
57 NUMBER OF UNITS DEMANDED	61919.00	0.	2.00	0.	0.	0.	0.	14470.00	3537.00	1624.00	58.00
58 PCT OFF-THE-SHELF	99.37	0.	100.00	0.	0.	0.	0.	100.00	97.63	100.00	100.00
59 PCT EXPEDITED REPAIR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
60 PCT PREEMPTION	0.	0.	0.	0.	0.	0.	0.	0.	2.37	0.	0.
61 PCT DEMANDS NOT SATIS.	.63	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
62 NUMBER OF CANNIBALIZATIONS	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
63 NO. ITEMS ON BACKORDER (EOP)	2.00	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

SUPPLY	TOTAL	BLDA4	BLDA5	PRK82	62FIN	82LST	82FUS	2CMB1	2CMB1	22PM	BLBB1
54 TOT DOLLAR INVEST.(1000)(EOP)	124261.56	700.00	700.00	139[illegible]	19960.00	19980.00	19980.00	200.00	0.	200.00	560.00
55 FILL RATE PERCENT	99.37	100.00	100.00	100.00	100.00	100.00	100.00	97.77	0.	100.00	88.00
56 NUMBER OF BACKORDER-DAYS	125.71	0.	0.	0.	0.	0.	0.	.50	0.	.00	50.55
57 NUMBER OF UNITS DEMANDED	61719.00	29.00	365.00	161.00	99.00	41.00	63.00	359.00	0.	8879.00	700.00
58 PCT OFF-THE-SHELF	99.37	100.00	100.00	100.00	100.00	100.00	100.00	97.77	0.	100.00	88.00
59 PCT EXPEDITED REPAIR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
60 PCT PREEMPTION	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
61 PCT DEMANDS NOT SATIS.	.63	0.	0.	0.	0.	0.	0.	2.23	0.	0.	12.00
62 NUMBER OF CANNIBALIZATIONS	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
63 NO. ITEMS ON BACKORDER (EOP)	2.00	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

SUPPLY	TOTAL	BLDB2	BLDB3	BLDB6	A20MM	AIKOC	AIMOS	AIM9	BLDC1	PAIMS	HOLDA
54 TOT DOLLAR INVEST.(1000)(EOP)	123261.54	0.	0.	0.	19980.00	160.00	180.00	360.00	120.00	19980.00	160.00
55 FILL RATE PERCENT	99.37	0.	0.	0.	100.00	0.	100.00	100.00	100.00	100.00	97.55
56 NUMBER OF BACKORDER-DAYS	125.71	0.	0.	0.	0.	0.	0.	.00	0.	0.	1.47
57 NUMBER OF UNITS DEMANDED	61912.00	0.	0.	0.	24.00	0.	710.00	17750.00	390.00	121.00	3312.00
58 PCT OFF-THE-SHELF	99.37	0.	0.	0.	100.00	0.	100.00	100.00	100.00	100.00	97.55
59 PCT EXPEDITED REPAIR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
60 PCT PREEMPTION	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
61 PCT DEMANDS NOT SATIS.	.63	0.	0.	0.	0.	0.	0.	0.	0.	0.	2.43
62 NUMBER OF CANNIBALIZATIONS	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
63 NO. ITEMS ON BACKORDER (EOP)	2.00	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

SUPPLY	TOTAL	HOLDB	HOLDC	HOLDD	HOLDE	OTHER
54 TOT DOLLAR INVEST.(1000)(EOP)	124261.56	160.00	160.00	640.00	640.00	0.
55 FILL RATE PERCENT	99.37	100.00	100.00	100.00	100.00	0.
56 NUMBER OF BACKORDER-DAYS	125.71	0.	0.	0.	0.	0.
57 NUMBER OF UNITS DEMANDED	61719.00	2080.00	264.00	716.00	705.00	0.
58 PCT OFF-THE-SHELF	99.37	100.00	100.00	100.00	100.00	0.
59 PCT EXPEDITED REPAIR	0.	0.	0.	0.	0.	0.
60 PCT PREEMPTION	0.	0.	0.	0.	0.	0.
61 PCT DEMANDS NOT SATIS.	.63	0.	0.	0.	0.	0.
62 NUMBER OF CANNIBALIZATIONS	0.	0.	0.	0.	0.	0.
63 NO. ITEMS ON BACKORDER (EOP)	2.00	0.	0.	0.	0.	0.

PERFORMANCE SUMMARY — PERIOD FROM 0. TO 30.0 — LEVEL 2

	EQUIPMENT	TOTAL	MB4	5TON	10TON	25FLB	10FLB	4FORKS	6FORKS	10FORS	H-11	JAMER
68	TOT DOLLAR INVEST.(1000)(EOP)	60902.94	60.00	40.00	40.00	60.00	40.00	40.00	20.00	20.00	40.00	19980.00
69	EQUIPMENT HOURS AUTH. (100)	21902.40	21.60	14.40	14.40	21.60	14.40	14.40	7.20	7.20	14.40	7192.80
70	EQUIPMENT HOURS AVAIL. (100)	21902.40	21.60	14.40	14.40	21.60	14.40	14.40	7.20	7.20	14.40	7192.80
71	PCT USED-UNSCHED MAINT	.29	30.19	22.52	24.58	23.27	11.28	37.07	14.63	4.88	77.67	.00
72	PCT USED-SCHED MAINT	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
73	PCT UNUSED	99.71	69.81	77.48	75.42	76.73	36.72	62.93	85.37	95.12	22.33	100.00
74	NUMBER OF BACKORDER-DAYS	29.90	2.11	5.06	4.07	4.42	1.15	6.65	0.	0.	1.07	0.
75	NUMBER OF UNITS DEMANDED	11089.00	2142.00	266.00	261.00	306.00	189.00	560.00	1.00	3.00	1617.00	13.00
76	PCT AVAILABLE	94.32	99.07	79.86	76.07	89.34	96.41	95.00	100.00	100.00	95.42	100.00
77	PCT PROV. BY EXPEDITE	.10	.28	.35	.36	0.	0.	0.	0.	0.	0.	0.
78	PCT PROV. BY PREEMPTION	.23	0.	.35	.71	0.	0.	0.	0.	0.	.62	0.
79	PCT DEMANDS NOT SATIS.	5.35	.65	19.44	22.00	10.66	1.59	5.00	0.	0.	3.96	0.
80	EQUIP HOURS BACKLOG(100)(EOP)	.00	.00	0.	0.	0.	0.	0.	0.	0.	0.	0.

	EQUIPMENT	TOTAL	4FORKC	6FORKC	10FORC	1HTON	2HTON	MHU12	MHU85	MHU11	CLOCK	TIMER
68	TOT DOLLAR INVEST.(1000)(EOP)	60902.94	20.00	20.00	40.00	40.00	20.00	202.94	120.00	120.00	19980.00	19980.00
69	EQUIPMENT HOURS AUTH. (100)	21902.40	7.20	7.20	14.40	14.40	7.20	50.40	43.20	43.20	7192.80	7192.80
70	EQUIPMENT HOURS AVAIL. (100)	21902.40	7.20	7.20	14.40	14.40	7.20	50.40	43.20	43.20	7192.80	7192.80
71	PCT USED-UNSCHED MAINT	.29	80.95	72.27	46.49	38.25	1.54	.10	.12	.11	0.	0.
72	PCT USED-SCHED MAINT	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
73	PCT UNUSED	99.71	19.05	27.73	53.51	61.75	98.46	99.90	99.88	99.89	100.00	100.00
74	NUMBER OF BACKORDER-DAYS	29.90	2.20	0.	0.	1.76	0.	.20	.61	0.	0.	0.
75	NUMBER OF UNITS DEMANDED	11089.00	940.00	7.00	8.00	2140.00	10.00	2460.00	21.00	12.00	1.00	30.00
76	PCT AVAILABLE	94.32	82.77	42.86	50.00	92.24	100.00	99.72	95.24	100.00	100.00	100.00
77	PCT PROV. BY EXPEDITE	.10	.11	0.	12.50	.05	0.	0.	0.	0.	0.	0.
78	PCT PROV. BY PREEMPTION	.23	.53	57.14	37.50	.05	0.	0.	0.	0.	0.	0.
79	PCT DEMANDS NOT SATIS.	5.35	16.60	0.	0.	7.62	0.	.28	4.76	0.	0.	0.
80	EQUIP HOURS BACKLOG(100)(EOP)	.00	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

	EQUIPMENT	TOTAL	3/4TON	OTHER
68	TOT DOLLAR INVEST.(1000)(EOP)	60902.94	30.00	0.
69	EQUIPMENT HOURS AUTH. (100)	21902.40	7.20	0.
70	EQUIPMENT HOURS AVAIL. (100)	21902.40	7.20	0.
71	PCT USED-UNSCHED MAINT	.29	14.52	0.
72	PCT USED-SCHED MAINT	0.	0.	0.
73	PCT UNUSED	99.71	85.48	0.
74	NUMBER OF BACKORDER-DAYS	29.90	0.	0.
75	NUMBER OF UNITS DEMANDED	11089.00	0.	0.
76	PCT AVAILABLE	94.32	0.	0.
77	PCT PROV. BY EXPEDITE	.10	0.	0.
78	PCT PROV. BY PREEMPTION	.23	0.	0.
79	PCT DEMANDS NOT SATIS.	5.35	0.	0.
80	EQUIP HOURS BACKLOG(100)(EOP)	.00	0.	0.

Initialization Dictionaries

RESOURCES WITH MAX.AUTHORIZED AND MAX.USED INFO, AND A FLAG THAT = '*' IF MXAUTH IS LESS THAN MXUSE

NO.	NAME	MXAUTH	MXUSE	FLAG
1	1FX	0	0	
2	431FS	200	2	
3	462X3	200	4	
4	PILOT	200	1	
5	46TS3	200	1	
6	461SS	200	2	
7	461C3	200	4	
8	461CS	200	1	
9	H82A1	999	2	
10	H82B1	999	2	
11	H52C1	999	2	
12	H82D1	999	2	
13	H82E1	999	2	
14	H82A2	999	2	
15	H32B2	999	2	
16	H82C2	999	2	
17	H32D2	999	2	
18	H82E2	999	2	
19	H82A3	999	2	
20	H32B3	999	2	
21	H82C3	999	2	
22	H82D3	999	2	
23	H82E3	999	2	
24	MK62	999	96	
25	3LDA1	999	25	

NO.	NAME	MXAUTH	MXUSE	FLAG
26	3LDA2	999	29	
27	3LDA3	999	23	
28	3LDA4	999	24	
29	3LDA5	999	25	
30	PMK62	999	1	
31	82FIN	999	1	
32	82BST	999	1	
33	82FUS	999	1	
34	20MD1	999	1	
35	20MU1	999	1	
36	20MM	999	96	
37	3LDB1	999	28	
38	3LDB2	999	28	
39	3LDB3	999	28	
40	3LDB4	999	23	
41	P20MM	999	1	
42	AIM9C	999	1	
43	AIM9E	999	1	
44	AIM7	999	96	
45	3LDC1	999	6	
46	PAIM9	999	1	
47	HOLDA	999	4	
48	HOLDB	999	4	
49	HOLDC	999	4	
50	HOLDD	999	4	

NO.	NAME	MXAUTH	MXUSE	FLAG
51	HCLDE	999	4	
52	ME4	999	1	
53	STCN	999	1	
54	1CTON	999	1	
55	25FLB	999	1	
56	4CFLB	999	1	
57	6FORKS	999	1	
58	6FORKS	999	1	
59	1CFORS	999	1	
60	H-11	999	1	
61	4FORKC	999	1	
62	6FORKC	999	1	
63	10FORC	999	1	
64	JAMER	999	1	
65	1HTON	999	1	
66	3/4TON	999	0	
67	2HTON	999	1	
68	MHU12	999	1	
69	MHU85	999	1	
70	MHU1	999	1	
71	CLOCK	999	0	
72	FRAM	999	0	
73	(BLNK)	9999	0	

TASKS

1 - PREFLT	2 - N	3 - LDMK82	4 - SORTIE	5 - PSTFLT	6 - REFUEL
7 - GMB2AT	8 - GMB2B1	9 - GMB2C1	10 - QMB2D1	11 - QMB2E1	12 - QMB2A2
13 - GMB2B2	14 - GMB2C2	15 - GMB2D2	16 - QMB2E2	17 - QMB2A3	18 - QMB2B3
19 - GMB2C3	20 - GMB2D3	21 - GMB2E3	22 - GHOLDA	23 - GHOLDB	24 - GHOLDC
25 - GHOLDD	26 - GHOLDE	27 - GMHU12	28 - GMHU85	29 - GMHU11	30 - GMN112
31 - GMK82	32 - TMK81A	33 - TMK82A	34 - TMK83A	35 - TMK84A	36 - TMK85A
37 - ENTER	38 - TBLDA1	39 - TBLDA2	40 - TBLDA3	41 - TBLDA4	42 - TBLDA5
43 - QPMK82	44 - Q82FI.	45 - Q820ST	46 - Q82FUS	47 - GBLDA1	48 - GBLDA2
49 - GBLDA3	50 - GBLDA4	51 - GBLDA5	52 - MK82D1	53 - MK82A1	54 - MK82B1
55 - MK82C1	56 - MK82D1	57 - MK82E1	58 - DELIV1	59 - MK8203	60 - MK8204
61 - G5TON	62 - G10TON	63 - G25FLB	64 - G40FLB	65 - G2HTON	66 - G1HTON
67 - MK82D5	68 - MK8205	69 - MK82A5	70 - MK8265	71 - MK82C5	72 - MK82E5
73 - MK8213	74 - MK8216	75 - MK8219	76 - QMHU12	77 - GM82A1	78 - GM82B1
79 - GM82C1	80 - GM82D1	81 - GM82E1	82 - QMHU85	83 - GM82A2	84 - GM82B2
85 - GM82C2	86 - GM82D2	87 - GM82E2	88 - QMHU11	89 - GM82A3	90 - GM82B3
91 - GM82C3	92 - GM82D3	93 - GM82E3	94 - DCMTA	95 - LD20MM	96 - Q20MD1
97 - G20MB1	98 - GHLD2D	99 - GHLD2B	100 - T20M1A	101 - T20M2A	102 - T20M3A
103 - T20M4A	104 - T20M5A	105 - TBLDB1	106 - TBLDB2	107 - TBLDB3	108 - TBLDB4
109 - TBL2A1	110 - G20MM	111 - GP20MM	112 - GBLDB1	113 - GBLDB2	114 - GBLDB3
115 - GBLDB4	116 - GBL2A1	117 - 20MMA1	118 - 20MMB1	119 - 20MMC1	120 - 20MMD1
121 - 20MME1	122 - 20MAF1	123 - 20MMD3	124 - 20MMD5	125 - 20MMD6	126 - G20MA1
127 - G20MB1	128 - DCMTB	129 - LDAIM9	130 - QAIM9C	131 - QAIM9E	132 - GHLD2C
133 - GHLD2E	134 - TAIM91	135 - TAIM92	136 - TAIM93	137 - TAIM94	138 - TAIM95
139 - TBLDC1	140 - TBL2A5	141 - GAIM9	142 - QPAIM9	143 - GBLDC1	144 - GBL2A5
145 - AIM9A1	146 - AIM9B1	147 - AIM9C1	148 - AIM903	149 - AIM904	150 - GAIM9C
151 - GAIM9E	152 - DCMTC	153 - TIME	154 - RMB4	155 - RSTON	156 - R10TON
157 - R25FLB	158 - R40FLB	159 - R4FORS	160 - R6FORS	161 - R10FRS	162 - RH-11
163 - RJAMR	164 - R4FORC	165 - R6FORC	166 - R10FRC	167 - R1HTON	168 - R2HTON
169 - RMHU12	170 - RMHU11	171 - RMHU85	172 - DUMAY		

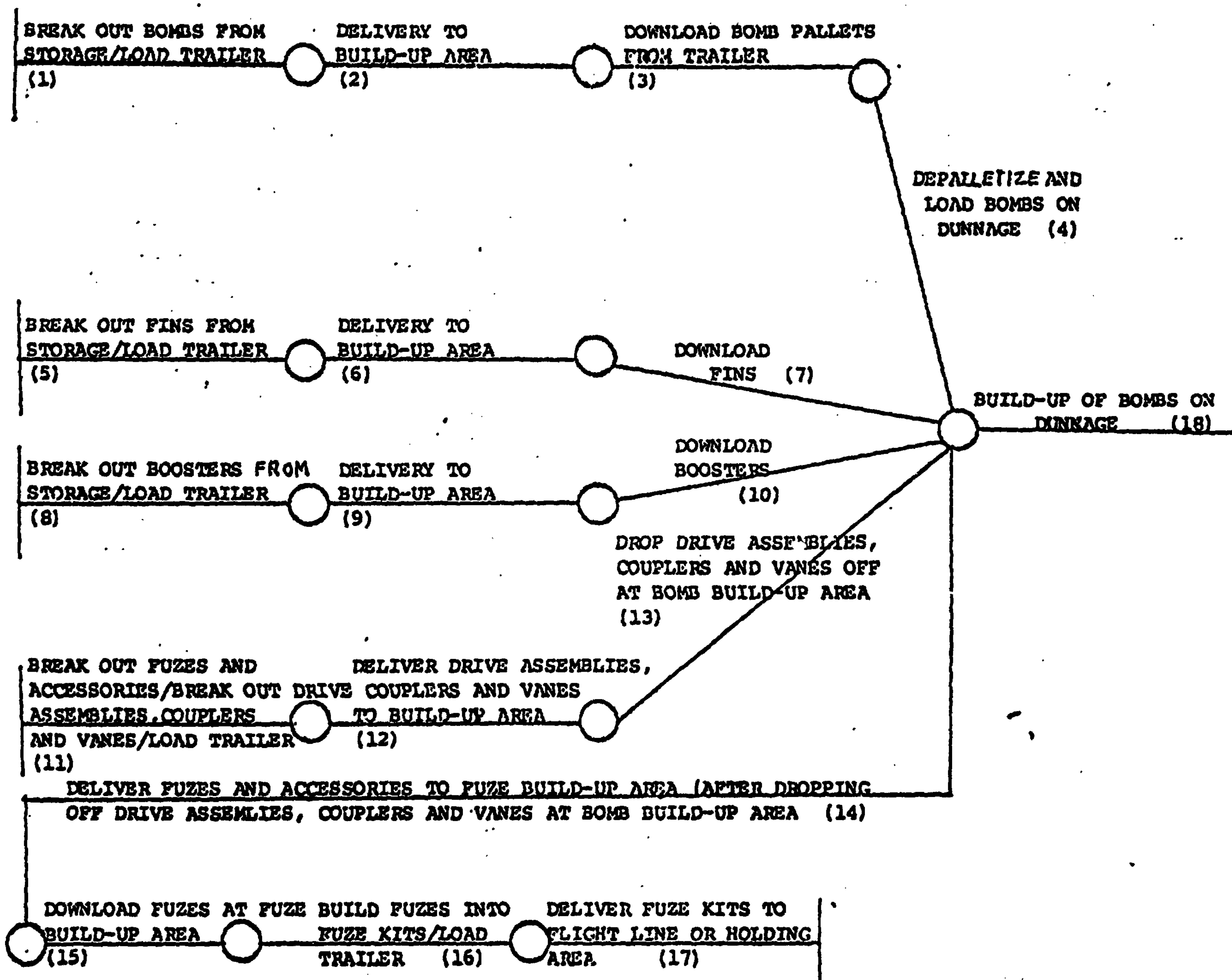
FAILURE CLOCKS

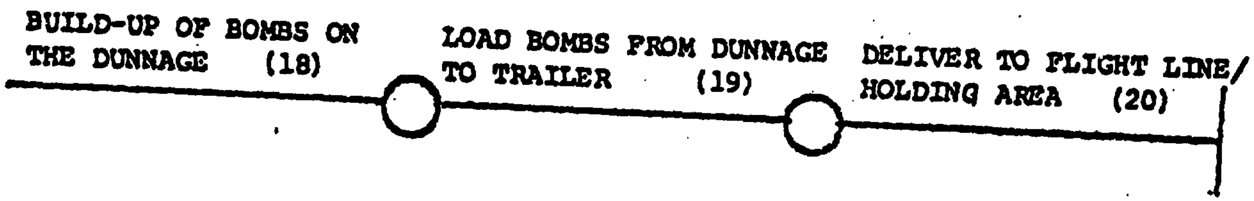
1 - HOLDA	2 - HOLDB	3 - HOLDC	4 - HOLDD	5 - HOLDE	6 - HMHU12
7 - HMHU85	8 - HMHU11	9 - HMK82	10 - HBLDA1	11 - HBLDA2	12 - HBLDA3
13 - HBLDA4	14 - HBLDA5	15 - HRMK82	16 - HLD2D	17 - HLD2B	18 - HBLDB1
19 - HBLDB2	20 - HBLDB3	21 - HBLDB4	22 - HBL2A1	23 - HG20MM	24 - HR20MM
25 - HLD2C	26 - HLD2E	27 - HBLDC1	28 - HBL2A5	29 - HGAIM9	30 - HRAIM9
31 - FMB4	32 - F5TON	33 - F10TON	34 - F25FLB	35 - F4FORS	36 - F40FLB
37 - F6FORS	38 - F10FRS	39 - FH-11	40 - FIAMR	41 - F4FORC	42 - F6FORC
43 - F10FRC	44 - F1HTON	45 - F2HTON	46 - FMHU12	47 - FMHU85	48 - FMHU11

Appendix C

MK82 INPUT DATA

MARK-82 NETWORK




BUILD-UP OF BOMBS ON THE DUNNAGE (18)
LOAD BOMBS FROM DUNNAGE TO TRAILER (19)
DELIVER TO FLIGHT LINE/ HOLDING AREA (20)

TASK:

(1) Break out bombs from storage & load trailer

NARRATIVE/DESCRIPTION:

Task starts when frag order is given and ends when trailer or truck is loaded and ready for delivery.

RESOURCES NEEDED:

1) 5 or 10 ton tractor

2) 25' or 40' flatbed trailer

3) 4,6 or 10 thousand pound forklift

4) crew of 3x461's

TIME:

1 hour to load 8 pallets on 25' flatbed or 10 pallets on 40' flatbed

COMMENTS:

TASK:

(2) Delivery to Build-up Area

NARRATIVE/DESCRIPTION:

RESOURCES NEEDED:

1) tractor from previous task

2) flatbed from previous task

3) 2x 461's

TIME:

depends on speed of vehicle and distance traveled

COMMENTS:

TASK:

(3) Download bomb pallets from trailer

NARRATIVE/DESCRIPTION:

RESOURCES NEEDED:

1) tractor from previous task

2) flatbed from previous task

3) 4,6 or 10 thousand pound forklift

4) 3x 461's

TIME:

20 minutes

COMMENTS:

TASK:

(4) Depalletize and load bombs on dunnage

NARRATIVE/DESCRIPTION:

This task includes cleanup

RESOURCES NEEDED:

1) M-11 crane, jammer or forklift(4.6 or 10,000 lb.)

2) 4x461's

TIME:

9 minutes / pallet

COMMENTS:

TASK:

(5) Break out fins from storage & load trailer

NARRATIVE/DESCRIPTION:

Task starts when frag order is given and ends when trailer or truck is loaded and ready for delivery.

RESOURCES NEEDED:

1) 1½ ton truck, 2½ ton truck, 25' or 40' flatbed with 5 or 10 ton tractor

2) 4,6 or 10,000 pound forklift

3) 3x461's

TIME:

45 minutes

COMMENTS:

70 to 100 fins can be loaded on the various vehicles depending on size.

TASK:

(6) Delivery to Build-up Area

NARRATIVE/DESCRIPTION:

RESOURCES NEEDED:

1) vehicle from previous task

2) 2x461's

TIME:

depends on speed of vehicle and distance traveled.

COMMENTS:

TASK:

(7) Download fins at bomb build-up area

NARRATIVE/DESCRIPTION:

RESOURCES NEEDED:

1) vehicle from previous task

2) 4,6 or 10,000 lb. forklift

3) 3x 462's

TIME:

20 minutes

COMMENTS:

TASK:

(8) Break out Boosters from storage / load trailer

NARRATIVE/DESCRIPTION:

Task starts when order is given to perform task and ends when truck or trailer is loaded and ready for delivery. Task assumes 904 and 905 fuses.

RESOURCES NEEDED:

1) 1½ ton truck, 2½ ton truck, 25' or 40' flatbed with 5 or 10 ton tractor

2) 4,6 or 10,000 lb. forklift

3) 3x 461's

TIME:

45 minutes to load 200 boosters on truck or trailer

COMMENTS:

One load consists of approx. 200 boosters

TASK:

(9) Delivery to Build-up Area

NARRATIVE/DESCRIPTION:

RESOURCES NEEDED:

1) vehicle from previous task

2) 2x 461's

TIME:

depends on speed of vehicle and distance traveled

COMMENTS:

TASK:

(10) Download Boosters at bomb build-up area

NARRATIVE/DESCRIPTION:

RESOURCES NEEDED:

1) vehicles from previous task

2) 4,6 or 10,000 lb. forklift

3) 3x 461's

TIME:

20 minutes

COMMENTS:

TASK:

(11) Break-out fuzes& accessories/break-out drive assemblies, couplers & vanes / load trailer

NARRATIVE/DESCRIPTION:

These two sets of bomb components are frequently stored close to each other and the truck/trailer will stop at each location. The same equipment will be used at each storage location. 904 and 905 fuzes are assumed.

RESOURCES NEEDED:

1) 1½ ton, 2½ ton truck, 25' or 40' flatbed (with 5 or 10 ton tractor)

2) 4,6 or 10,000 lb. forklift

3) 3x 461's

TIME:

1 hour for 17 pallets (102 bombs)

COMMENTS:

TASK:

(12) Deliver drive assemblies, couplers and vanes to build-up area

NARRATIVE/DESCRIPTION:

RESOURCES NEEDED:

1) vehicle from previous task

2) 2x 461's

TIME:

depends on distance traveled from storage area to build-up area, and speed of vehicle.

COMMENTS:

TASK:

(13) Drop drive assemblies, couplers and vanes off at bomb build-up area

NARRATIVE/DESCRIPTION:

Downloading of drive assemblies, couplers and vanes at bomb build-up area.

Fuzes and accessories remain on truck/trailer for delivery to fuse build-up area.

RESOURCES NEEDED:

1) vehicle from prior task

2) forklift (4,6 or 10,000 lb.)

3) 3 x 461's

TIME:

10 minutes (to download enough for 102 bombs)

COMMENTS:

TASK:

(14) Deliver fuzes and accessories to fuze build-up area

NARRATIVE/DESCRIPTION:

RESOURCES NEEDED:

1) vehicle from prior task

2) 2 x 461's

TIME:

depends on distance traveled and speed of vehicle

COMMENTS:

TASK:

(15.) Download fuzes at fuze build-up area

NARRATIVE/DESCRIPTION:

Enough fuzes and accessories will be downloaded for 102 bombs.

RESOURCES NEEDED:

1) vehicle from prior task

2) 4,6 or 10,000 pound forklift

3) 2 x 461's

TIME:

30 minutes

COMMENTS:

TASK:

(16) Build fuzes into fuze kits/ load trailer

NARRATIVE/DESCRIPTION:

The trailer is loaded as the kits are assembled. Enough kits are assembled for 102 bombs. 34 boxes of fuze kits will need to be put together and loaded on the MHU-12M for 102 bombs.

RESOURCES NEEDED:

1) 4 x 461's

2) MHU-12M trailer

TIME:

5 hours

COMMENTS:

TASK:

(17) Deliver fuse kits to Flightline

NARRATIVE/DESCRIPTION:

RESOURCES NEEDED:

1) MHU-12M trailer loaded with fuse kits

2) 3/4 ton 6 passenger truck, farm tractor, $1\frac{1}{2}$ ton truck (or any prime mover available with towing capability- preferably not the heavier tugs)

3) 2 x 461's

TIME:

depends on distance from fuze build-up area to flightline and speed of vehicle

COMMENTS:

TASK:

(18) Build-up of bombs on dunnage

NARRATIVE/DESCRIPTION:

Includes installing boosters in bombs, installing drive assemblies, couplers and vanes to tail fins, installing tail fins on bombs, and clean-up.

Process assumes 904 and 905 fuses.

RESOURCES NEEDED:

1) 4x 461's working in pairs in production line fashion

TIME:

4 minutes / bomb (or 8 min. if only 2 x 461's are available)

COMMENTS:

TASK:

(19) Load bombs from dunnage onto trailer

NARRATIVE/DESCRIPTION:

RESOURCES NEEDED:

1) H-11, jammer or forklift (4,6 or 10,000 lb.)

2) MHU-12M, MHU-85 or MHU-110 trailer

3) 3 x 461's

TIME:

8 minutes to load one trailer

COMMENTS:

TASK:

(20) Deliver to flightline

NARRATIVE/DESCRIPTION:

Deliver from bomb build-up area to flightline. Each prime mover may pull 2 trailers at a time.

RESOURCES NEEDED:

1) trailers loaded with bombs

2) MB-4 Coleman tug, 5 or 10 ton tractor with pintle hook

3) 2 x 461's

TIME:

depends on distance traveled and speed of vehicle

COMMENTS:

Appendix D

AFLMC PROJECT PLAN #781040

PROJECT PLAN

SIMULATION MODEL OF CONVENTIONAL MUNITIONS BUILDUP

FOR

ANALYZING RESOURCE REQUIREMENTS

PROJECT NUMBER: 781040

APPROVED: 22 AUG 1980

LEONARD L. CLARK, Colonel, USAF
Commander

AIR FORCE LOGISTICS MANAGEMENT CENTER
GUNTER AIR FORCE STATION, ALABAMA 36114

SIMULATION MODEL OF CONVENTIONAL MUNITIONS BUILDUP

FOR

ANALYZING RESOURCE REQUIREMENTS

PROJECT PLAN

1. PROJECT NUMBER: 781040

2. PROJECT MANAGER: Capt Mark Greenly, AFLMC/LGM

3. TEAM MEMBERS: Lt Karen Daniels, AFLMC/LGY

4. OBJECTIVE: Develop a methodology to determine the effect of changes in munitions support resources on sortie generation. Any methodology developed must be able to do at least the following:

   a. Determine alternative mixes of resources (manpower, vehicles, trailers, etc.) capable of supporting a given sortie rate.

   b. Determine the effects on sortie support of changes in one or more resource levels.

   c. Identify production bottlenecks caused by insufficient resources.

5. BACKGROUND:

   a. Serious deficiencies have been identified in the process of creating munitions area inputs for Mission Area Analysis. The AFLMC was tasked to develop: (1) a model for allocating munitions based on sortie needs; and (2) a methodology to determine the effect of changes in munitions support resources (manpower, munitions handling equipment, test equipment, vehicles, etc.) on sortie generation. The original proposal was submitted by Col Ryan of HQ USAF/LEYW.

   b. The AFLMC concluded, in their preliminary analysis, that suitable models for allocating munitions to sorties were already available. Therefore, project 781040 was established to pursue the objective in paragraph 4 above. Further, only conventional munitions are addressed in this study.

6. SCOPE:

   a. The model produced by this project will be able to simulate base-level conventional munitions production activities for a wide range of munitions, weapon systems, and sortie levels for all major commands.

b. Organizations involved.

1. PACAF/OA - Developers of a model, Munitions Production Simulation, possibly suitable for Air Force-wide use.

2. LCOM Users - Organizations conducting related studies using the Logistics Composite Model (LCOM).

3. AFMSMET/MEMT - Office which maintains LCOM as a system.

4. Potential users: Primarily, munitions and logistics planners at MAJCOM level.

5. Air Staff OPR: Major Peterson, HQ USAF/LEYWC.

7. METHODOLOGY AND DATA SOURCES:

a. Due to the complex nature of munitions support processes, development of a computer simulation model has been selected as the best approach to the problem. This methodology implies two project phases: (1) selection of modeling alternative and (2) development and testing. A detailed plan for phase two will not be written until the conclusion of phase one. The last activity in this plan is the writing of a follow-on plan to construct the actual model.

b. Activities A-D involve experimentation and familiarization with the current version of LCOM. They have been completed. The munitions networks constructed in Activity D may serve as a basis of comparison for munitions activities at other bases.

c. The purpose of Activity E is to gather specific information necessary to evaluate the alternative courses of action in model development. The bulk of this information will come from the ultimate model users. The information to be gathered will need to include such areas as:

(1) Specific munitions task sequences peculiar to each MAJCOM.

(2) Accuracy and availability of input data.

(3) Computer resources and expertise available to users. This information will be analyzed, and the results will be used to develop a list of needed model characteristics to determine the amount of flexibility and detail needed.

e. Four modeling alternatives will be examined:

1. Use of the PACAF/OA munitions model (as is or with modification). Since this model is still being tested, analysis will progress as data is received from PACAF/OA. (Activity F)

2. Use of LCOM II Version 3.5.4 (to be released in Fall 1980). This will be accomplished through discussions with knowledgeable LCOM users at the October 1980 LCOM Steering Group. (Activity G)

3. Design of a new model by AFLMC or by contractors (Activity H)

The investigation of each alternative will consist of judging its suitability according to the criteria established in Activity E. The costs and benefits will be analyzed. The results will be reported in a working paper at the end of each activity.

f. After the options in Activities F, G, and H have been initially evaluated, a working group will convene at the AFLMC to review the progress on development of model requirements and characteristics, and the AFLMC views on each option (Activity J). This group will include MAJCOM representatives (potential users), project team members, and other interested parties.

g. After the meeting, an interim report will be written to summarize meeting results and recommend what type of model to develop (or modify). This report represents a decision point regarding which, if any, of the options to pursue through development and testing.

8. ASSUMPTIONS AND CONSTRAINTS: Any munitions simulation developed needs to be; (a) understandable to users; (b) flexible enough to model many bases and munitions types; (c) detailed enough to keep track of individual munitions components and vehicles; (d) small enough and quick enough (in terms of computer resources) to run on the computer systems available to users; and (e) rigorously tested to insure a high level of confidence in model outputs.

Since any simulation model must reflect the users' environment and situations, this entire project will require accurate and timely user inputs and cooperation in all project phases.

9. RESOURCES REQUIRED: Manpower support will be from AFLMC/LGM and AFLMC/LGY. Computer support will be required for model development but cannot be determined until the follow-on plan (phase two) is written. Information on the required manpower and TDY trips is provided in the attachments.

10. MILESTONES:

Milestones	Expected Completion Dates
LCOM II Version 3.5E Familiarization	Completed
Evaluation of LCOM II Version 3.5E	Completed
Gather Available Info for LCOM Study	Completed
Build LCOM Networks	Completed
Develop Model Requirements	15 Oct 80
Evaluate LCOM II	15 Nov 80
Evaluate PACAF/OA Munitions Simulation	30 Nov 80
Assess In-House or Contracting Capabilities	21 Feb 81
Working Group	24 Mar 81
Interim Report	30 Jun 81

VITA

Michael Hanks Gilchrist was born on 19 June 1945 in San Louis Obispo, California. He graduated from high school in Oxen Hill, Maryland in 1963. He was appointed to the United States Air Force Academy in 1964 and graduated from that institution in June 1968 with a Bachelor of Science in Electrical Engineering. Following graduation from pilot training at Webb Air Force Base, Texas in 1969, he served a tour in Vietnam as a Forward Air Controller in the O-2A. His next assignment was to Fairchild Air Force Base, where he served as a KC-135 aircraft commander and instructor pilot from 1971 to 1975. Completing an assignment to the School of Engineering, Air Force Institute of Technology in 1976, he was assigned as a Manpower Plans Staff Officer at the Directorate of Manpower Plans, Headquarters Tactical Air Command. He completed that tour in May 1980 and is currently enrolled as a student in the Air Command and Staff College, Maxwell Air Force Base, Alabama.